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NUMBER 76 MAY 1944

THE BULLETIN

OF THE

U. S. Army Medical Department

A periodical containing original articles, reviews, news, and abstracts of interest to the Medical Department of the Army

ISSUED UNDER THE AUSPICES OF
THE OFFICE OF THE SURGEON GENERAL

PUBLISHED MONTHLY AT THE MEDICAL FIELD SERVICE SCHOOL,
CARLISLE BARRACKS, PENNSYLVANIA

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By direction of the Secretary of War, the material contained herein is published as administrative information and is required for the proper transaction of the public business.

NORMAN T. KIRK
Major General, U. S. Army,
The Surgeon General.

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OFFICE OF THE SURGEON GENERAL,
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U. S. Army Medical Department

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Foreword

With the October 1943 issue, The Bulletin became a monthly periodical, instead of a quarterly, dedicated to keeping the personnel of the Medical Department informed on developments in war medicine. The new publication, known as The Bulletin of the U. S. Army Medical Department, absorbed the former quarterly dental and veterinary bulletins and will have material devoted to those fields in each issue.

The Bulletin is intended to be educational rather than directive in nature. It will contain the best information obtainable concerning military medical experience, observations, and procedure that may help to improve further the quality of professional services. The Bulletin will be a medium whereby experience gained in one theater of combat may be shared with those serving in other combat areas and with those in this country who are preparing for overseas duty. News items concerning military and scientific developments as well as original articles will be emphasized. The Bulletin, however, should not serve as a basis for the forwarding of requisitions for equipment or supplies referred to therein.

Obviously, some of the most interesting field experiences cannot be divulged in a periodical of this kind when our country is at war. The Bulletin will, however, publish that which can be safely told, drawing not only on current literature, but on many authoritative reports which reach The Surgeon General's Office from the field. Officers are invited to submit for publication reports of their field experiences that can profitably be shared with other officers.

The Medical Department has been commended for its work in caring for the sick and wounded in theaters of operations in war. The Bulletin will endeavor to stimulate such progress and to advance further the high standard of medical service in the Army of the United States.

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News and Comment

PENTOTHAL ANESTHESIA

Recent observations in a report from overseas on sodium pentothal are of special significance in view of the widespread use of this anesthetic agent throughout the Army. On analysis of 7,500 case samples of anesthesia, the death rate attributable to pentothal was found to be six times higher than the death rate from all other anesthetic agents combined. This emphasizes the importance of its consideration and probably indicates the unwise use of pentothal rather than its inadequacy for military purposes. The advantages associated with the use of pentothal as an anesthetic agent have been so impressive that its dangers and disadvantages have been overlooked or have not been fully realized.

Pentothal, like all barbiturates, is depressant to the central nervous system, especially the respiratory center. By destroying the sensitivity of the respiratory center to its normal chief stimulus, carbon dioxide, under full pentothal anesthesia the body must make use of a supplementary mechanism to maintain respiration. Accordingly, a shift is made from the driving action of carbon dioxide on the respiratory center to the anoxemic stimulus which acts through the sino-aortic mechanism. The respiratory stimulation of pentothal may then be interpreted by uninformed anesthetists as an indication that the patient is waking up rather than that the patient is not getting enough oxygen and a wrong interpretation here leading to the further administration of pentothal can cause the patient's death. Since the true depth of pentothal anesthesia is difficult to determine when there is a low oxygen content in the blood, the administration of oxygen with pentothal is always desirable and should certainly be done in the longer operative procedures. Since carbon dioxide is a depressant to respiration under pentothal anesthesia, its use as a respiratory stimulant in the treatment of respiratory depression caused by pentothal is contraindicated.

Pre-anesthetic medication is particularly important. The preliminary administration of morphine is believed to lessen the quantity of pentothal needed. It must be realized that morphine is also a respiratory depressant. More important, however, is the use of atropine in order to minimize vagal

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reflexes. Atropine 1/100 of a grain subcutaneously should be given about one hour preceding anesthesia, with half the dose (1/200 of a grain) intravenously just before anesthesia is started for major cases. If there is not time for the above, 1/100 of a grain intravenously 10 or 15 minutes preceding anesthesia should be given. When laryngospasm occurs during pentothal anesthesia, atropine 1/100 of a grain should be administered intravenously as soon as possible even though the same dose may have been administered previously in pre-anesthetic medication. Atropine is to be avoided in the presence of a severe attack of tachycardia.

In the presence of certain types of injuries or conditions, the use of pentothal is hazardous. Among the most important of these are morphine overdosage, shock, infections of the neck, and liver damage. The danger of pentothal in operations on cervical or sublingual infections has been repeatedly emphasized and a number of deaths have been reported under such circumstances. Apparently, inflammation in the region of the carotid bodies and sinuses causes sensitization of reflexes arising there. Because pentothal anesthetizes the central nervous system more rapidly than the carotid sinus, these reflexes initiated by operative trauma exert a relatively more powerful inhibitory effect on the respiratory center, thus accounting probably for the notorious incidence of sudden death during such operations. Since pentothal and other barbiturates are not very effective in depressing these reflexes, its choice should be avoided in most cases of this kind. Rarely, in some cases such as compound fractures of the face, pentothal may be the reasonable choice for handling cervical abscesses. In such cases, certain precautions should be observed. These include heavy atropinization in the pre-anesthetic medication, a delay in beginning surgery of at least ten minutes after induction of anesthesia, the avoidance of pressure on the carotids, and, if feasible, blocking them with local anesthesia.

There are certain other conditions in which pentothal should either be avoided or used with great caution. In general, pentothal should be avoided when the operative position or procedure may interfere with the airway or make artificial respiration difficult, as in operations that must be performed in the face-down position, in operations on maxillofacial injuries or other injuries involving the airways. In intracranial

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surgery, pentothal is not considered a wise choice because such operations are usually long and are associated with great blood loss. Moreover, anoxia which may be due to unexpected respiratory depression produces immediate swelling of the brain and may make an intracranial procedure difficult or impossible. Patients with severe burns seem to tolerate pentothal anesthesia poorly.

Pentothal has proved exceptionally valuable in military medicine in procedures in which relaxation is not essential and for short (half-hour) procedures in men in good condition. The use of 2½ percent solution, the routine administration of oxygen, and the frequent observation of pulse and blood pressure during anesthesia are considered important factors in the safe use of pentothal.

RHEUMATIC FEVER

The incidence of rheumatic fever in the Army appears to have increased since the outbreak of the war; however, so far as available statistics show, it remains below the incidence in World War I. From the point of view of the noneffective rate, rheumatic fever is not a serious disease in the Army; but there is special interest in this disease because of its concentration in certain regions of the United States, the uncertain etiology, its definite relation to certain common acute infections, and the disabling sequelae.

While the exact cause of rheumatic fever is still unrecognized, its association with acute sore throat suggests a causal relationship with hemolytic streptococci. Recent research indicates that the characteristic symptoms of rheumatic fever are allergic manifestations on the part of sensitized body tissues to invasion by this microorganism or its products.

Three significant epidemiological features of rheumatic fever have been observed in troops in the United States.

1. Seasonal distribution. The peak incidence tends to occur in the month of May. Scarlet fever and other streptococcal diseases usually reach their peak in March.

2. Geographic distribution. There has been a markedly higher prevalence of rheumatic fever in the Rocky Mountain region of the Seventh Service Command, particularly in Colorado and Wyoming, than in other portions of the country. This agrees fairly well with civilian data collected by various

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observers. Civilian rates tend to be lowest in portions of the country south of the 35th parallel of latitude. While there are a number of exceptions, it appears that tropical and subtropical regions have far less rheumatic fever than do areas in the North Temperate Zone where low winter temperatures are encountered. The distribution however does not follow any regular pattern.

3. Relation to other diseases. At individual posts a high incidence of rheumatic fever often follows a winter during which scarlet fever or streptococcal sore throat has been common; in certain posts it has followed a high prevalence of common respiratory diseases not identified as streptococcal. In these cases it is possible that unrecognized or unreported streptococcal infections actually constituted a considerable part of the total respiratory admission rate.

The majority of cases in the Seventh Service Command have developed in men who had been in the service command several months. There has come to light no evidence that men from any particular section of the country are especially susceptible. The distribution of cases by length of military service has not yet been fully studied. Attention is called to the fact that acute rheumatic fever admissions should be reported in the Weekly Statistical Report, S.G.O. Form 86*ab*. It is from such reports that most of the foregoing information on military incidence was secured.

Treatment of the acute manifestations of the disease has been satisfactory. The majority of cases have been characterized by severe arthritis affecting several joints, a manifestation which has yielded promptly to the usual medical therapy. Of graver concern has been the effect on the heart. Twenty percent of the cases at one hospital developed evidence of at least transient injury to the heart. Disposition of the more severe cases has presented a problem. According to S.G.O. Circular Letter No. 144, dated 7 August 1943, individuals with cardiac damage are to be separated from the service and a specified period of close observation is required in all cases before returning them to full duty.

Prevention of relapse constitutes the chief medical problem in the convalescence of rheumatic fever patients. The Commission on Hemolytic Streptococcal Infections and the Commission on Air-Borne Infection, operating under the Board for the Investigation and Control of Influenza and

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Other Epidemic Diseases in the Army, appointed by the Secretary of War, is cooperating with Army hospitals in a study of the problem. Recently published investigations indicate that systematic administration of sulfonamide drugs may be effective in preventing attacks. There is reason to believe that avoidance of relapse will reduce the incidence of late cardiac sequelae of rheumatic fever.

BLOOD BANK IN EVACUATION HOSPITAL

The problem of providing whole blood for the treatment of casualties has been solved by one 400-bed evacuation hospital which developed a blood bank system for obtaining blood from donors outside its own personnel and keeping such blood available at all times. A request for donors of the various types required is made of outfits in the vicinity of the hospital, in sufficient numbers to maintain the reserve in the bank (35 pints) at a maximum at all times. This involves a call for donors either daily or every other day, depending on the number of casualties. In two weeks, 282 pints of blood were obtained from outside donors with a maximum of 68 donors being bled in one day. The blood was kept an average of twenty-four hours before being used; the greatest amount of blood used in any single period of twenty-four hours was 33 pints. The largest volume administered to any one patient was 8 pints; the average volume received by a patient requiring blood therapy was 2.8 pints.

In the experience of this evacuation hospital, the blood bank represents a method of facilitating the administration of transfusion therapy to such an extent that no patient need be denied the advantages of blood, in any required quantity, from the moment of his admission to hospital to his subsequent evacuation. It is a practical, swift method of having whole blood available for the patient shocked by acute blood loss, for the patient requiring repeated transfusion for anemia due to infection, and for the anemic casualty whose blood picture can be more readily brought to normal, ensuring a smoother convalescence.

Another 400-bed evacuation hospital reports that in fourteen and one-half days of activity, 80 transfusions of citrated blood were given, averaging 5.5 transfusions per day. During this same period, 272 units of plasma were given. Blood donors for the most part were ambulatory patients.

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RESTRICTION ON USE OF QUINIDINE

Conservation Order M-131 of the War Production Board, as amended 4 November 1943, restricts the use of quinidine to the treatment of cardiac disease. In compliance with this restriction, quinidine is not to be used by Army medical installations except for that purpose. The Committe on Drugs and Medical Supplies, Division of Medical Sciences, National Research Council, at a meeting, 9 February 1944, recommended to the Chief, Medical and Health Supplies Branch, Office of Civilian Requirements, War Production Board, that the use of quinidine be restricted to the following heart disorders: (1) ventricular tachycardia diagnosed electrocardiographically, (2) congestive heart failure precipitated by the sudden onset of auricular fibrillation, (3) persistent premature ventricular contractions following coronary artery occlusion, (4) chronic heart disease with paroxysmal auricular fibrillation, auricular tachycardia, or auricular flutter, and (5) history of systemic embolization in paroxysmal or established auricular fibrillation. This committee further recommended that quinidine not be combined with other drugs and that prescription of the drug be limited to not more than fifty 3-grain tablets for any acute attack of arrhythmia of the types indicated in the foregoing list, and to not more than thirty 3-grain tablets per week for the maintenance of sinus rhythm after re-establishment by quinidine.

EXTENSION OF MEAT INSPECTION SERVICE

A War Food Administration order which became effective on 1 April 1944 imposes a modified form of Federal meat inspection on all uninspected packers who slaughter 52 or more head of Army style beef cattle each week. These packers will be required to set aside for Government purchase at least 50 percent of their production of choice, good, commercial, and utility grade steer and heifer beef meeting the provisions of Army specifications. Packers affected by this order must qualify for Federal inspection, as all meat purchased for the armed forces must originate in Federally inspected plants. Through an agreement between the War Food Administration and the War Department, the Army Veterinary Corps will render assistance in providing inspection in these plants.

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TRANSFER OF AMPUTATION CASES

Circular Letter No. 91, Office of The Surgeon General, dated 26 April 1943, states that "All major amputees will be transferred as early as practicable after the primary amputation to general hospitals designated as amputation centers for revision of stumps and fitting of prosthesis." A number of amputation cases have been held in station hospitals or general hospitals which are not amputation centers until the stumps have healed or until skin grafts have been applied. This is contrary to the intent of the above-mentioned circular letter. These patients should be transferred to the proper center nearest their homes as soon as they are safely transportable, usually about two weeks after operation. All guilotine stumps should have early and continuous skin traction.

Minor amputations which do not require reamputation or prothesis should not be transferred to amputation centers. Incomplete loss of the fingers or loss of the toes does not warrant transfer. However, complete loss of all fingers or one hand or other special cases which may require fitting with a partial prosthesis and all major amputations including disarticulation at the shoulder or hip should be transferred for prosthetic fitting.

Amputation cases should be transferred from station and general hospitals direct to the appropriate center without intermediate transfer, as outlined in Part Two, A.S.F. Circular No. 31, dated 27 January 1944.

FLASH BURN PROTECTIVE CREAM

The Office of The Quartermaster General will procure, store, and issue a new item known as Flash Burn Protective Cream, which is intended to decrease the severity of burns resulting from sudden flash fires which may occur in tanks.

The cream, which was developed by the U. S. Naval Medical Research Institute, has been tested by the Army at the Armored Force Medical Research Laboratory, Fort Knox, Kentucky. The tests indicate that the cream prevents severe burns for a period of five seconds after a flash fire has started, such as a fire caused by enemy shells hitting the propelling charge of ammunition stored in the tank. This period of five seconds is sufficient to permit the escape of most of the crew in the tank.

The flash burn protective cream will be supplied in metal cans with screw tops, each can containing sufficient cream for two or three applications. It is now under contract, and deliveries are expected to be received within the next sixty days.

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TREATMENT OF MENINGOCOCCIC INFECTION IN SOLDIERS

This discussion is based on studies[1 2] of meningococcic infection in soldiers by Army medical officers in two widely separated camps in the United States. Important points in those studies on diagnosis and treatment are emphasized. The point of view that this disease is a generalized sepsis which may be overshadowed by the development of the more dramatic symptoms of meningitis is said to be essential. It is important also that the stage of sepsis be recognized early, and that the patient be treated promptly, for in this way the disease can be terminated usually before localization in the meninges occurs. It is a mistake to withhold treatment until a definite bacteriologic diagnosis has been made. If the clinical signs are those of early meningococcic infection, treatment should begin at once. The four cardinal clinical signs of meningococcic infection, the authors say, are headache, vomiting, chill, and rash.

Meningococcic sepsis usually begins with prodromal symptoms of disease of the upper respiratory tract and, after a period of from one to many days, usually a sudden chill occurs with rapid rise of temperature, but this may be gradual. Extreme weakness, malaise, aching of muscles, moderate headache, nausea and vomiting, and pains in the joints develop. The most characteristic manifestation is the rash, and its presence, Daniels and his associates say, is essential to clinical diagnosis prior to the advent of meningeal localization. The rash may be so sparse, however, that careful and frequent search is necessary to find it, or it may be obvious. These authors report that in only 56 percent of their cases with meningococcemia without meningitis was the diagnosis confirmed by a positive blood culture. This illustrates the very important point that an accurate diagnosis of meningococcemia can and must be made before there is a report on the results of blood culture if one hopes to prevent meningitis.

Treatment

Eighty cases of meningitis were observed by Daniels and his associates and of these 45 cases were given an initial dose of 0.1 gram of sodium sulfadiazine per kg. of body weight. A dose one-half of the initial dose was given paren-

1. Daniels, Worth B., Solomon, Sydney, and Jaquette, W. A., Jr.: Meningococcic Infection in Soldiers, J. A. M. A., 123:1-8, 4 Sept. 1943.
2. Hill, L. W., and Lever, H. S.: Meningococcic Infection in an Army Camp, J. A. M. A., 123:9-13, 4 Sept. 1943.

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terally every eight hours thereafter until the patient could retain the drug by mouth. Most of the subsequent parenteral therapy was given subcutaneously. A concentration of 0.5 percent or less of sodium sulfadiazine in isotonic solution of sodium chloride in sterile distilled water was used. Sulfadiazine was then given by mouth, 1.0 to 2.0 grams every four hours, until the temperature had been normal for five to seven days. This dosage was adjusted when necessary to maintain the blood concentration of sulfadiazine at 15 mg. per 100 cc. The fluid intake was maintained at 4,000 cc. daily, and the urinary output at 1,200 cc. or more. Daily complete blood counts and determinations of the sulfadiazine level and urinalyses were made. All patients in this group recovered, except one with fulminant meningitis who died soon after the diagnosis was made. The high incidence of renal complications, however, made it advisable to reduce the dose of sulfadiazine. Therefore another group of 33 patients was given an initial dose of 0.05 gm. of sodium sulfadiazine per kg. of body weight by vein, and four hours later 0.25 gm. per kg. of body weight subcutaneously. This dose was repeated every eight hours until the patient could retain the drug given by mouth. One gm. of sulfadiazine was then given every four hours until the temperature had been normal for from five to seven days. The other two patients received sulfapyradine and recovered. The same fluid intake and output were maintained as in the former group, with the same laboratory control.

Of the two groups of patients, those treated with the lower dose of sulfadiazine fared the better, and the important difference was the lower incidence of renal complications in those receiving the smaller dose of sulfadiazine.

The treatment of soldiers with meningococcemia without meningitis was simple and effective. An initial dose of 4 gm. of sulfadiazine was given, followed by 1 gm. every four hours until the temperature had been normal for two days. Parenteral administration was resorted to when patients were vomiting.

The use of specific serum should remain a part of the armamentarium for the treatment of patients with fulminant infection in whom response to sulfonamide compounds is not promptly achieved. In this series of 80 patients specific serum by vein was used in two patients who did not respond rapidly to sulfadiazine and both patients recovered.

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Hill and Lever[2] also strongly emphasize the importance of early diagnosis and treatment. In no disease, they say, is prompt energetic treatment more necessary. The aim should be to establish the diagnosis and start treatment before meningitis has developed. This schedule embodies their routine procedure:

1. Lumbar puncture, requesting white blood cell count, differential, smear, culture, sugar, and globulin.

2. Blood culture, white blood cell count, differential.

3. Diagnosis of meningitis on finding of cloudy fluid or positive smear or both.

4. If patient appears clinically to have meningitis or meningococcic septicemia, start on intravenous therapy regardless of appearance of spinal fluid or laboratory reports. This should be done immediately after spinal tap and blood culture are done.

5. Treatment: Sodium sulfadiazine 5 gm. in 100 cc. of distilled water intravenously (2 ampules of each) followed by 1,000 cc. of 5 percent dextrose in isotonic solution of sodium chloride. Eight hours later give 2.5 gm. of sodium sulfadiazine intravenously and follow with 1,000 cc. of 5 percent dextrose in isotonic solution of sodium chloride. Repeat eight hours later. In cases of stupor or in presence of nausea or vomiting, intravenous therapy to be continued every eight hours in the same manner. If condition is satisfactory, to be given eight hours after last intravenous dose, 1.5 gm. by mouth and repeated every four hours. Then changed to 1.5 gm. every six hours two days after temperature recedes.

6. If patient shows evidence of circulatory shock or failure, give 1,500 cc. of 5 percent dextrose in isotonic solution of sodium chloride intravenously and 2 cc. of adrenal cortex extract by hypodermic as often as may be required and treat for shock. When pulse and blood pressure respond and stabilize, discontinue. Sodium chloride 1/3 teaspoon by mouth every four hours to be given in conjunction with foregoing treatment. Blood pressure every three hours.

7. Orders: Daily sulfonamide levels. Daily urinalysis. Intake 3,000 cc. or better (sulfadiazine) ; 1,500 cc. (sulfanilamide). Blood pressure daily for three days. Intake and output chart. In cases showing mild periodic temperature elevations during convalescence, a blood culture is to be taken three days after discontinuing sulfonamide drug and patient is to be

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held in ward until (the blood culture is) read three days later. Throat cultures to be taken on fifth day after admission and every third day until two negative cultures have been obtained.

8. Serum: To be used only in following conditions: (1) fulminating cases in conjunction with sulfonamide drugs; (2) intolerance to all sulfonamide drugs.

RUSSIANS RETURN SEVENTY PERCENT OF WOUNDED TO ACTIVE SERVICE

In a speech at the tenth session of the Supreme Soviet of the U.S.S.R., the People's Commissar of Health Protection stated that hospitals of the Red Army Medical Administration and of the People's Commissariat of Health Protection returned more than 70 percent of all wounded men to active service, a percentage which has remained constant throughout the war. The mortality in hospitals is much lower than that of the first World War, and in hospitals of the People's Commissariat of Health Protection it is a little more than 1 percent. Whereas more than 60 percent of those with wounds of the extremities during the first World War had to undergo amputations, the number of amputations in the present war has been reduced to one-third. The mortality among patients with chest, spine, face, and jaw wounds has been reduced from three to four times.

Commissar Miterev said that tetanus was fatal in 80 percent of cases and gas gangrene caused death or amputation in the great majority of cases during the first World War; now, by means of specific serums, tetanus has practically been abolished and the cases of gas gangrene greatly reduced. With blood transfusion and the extensive network of blood donor centers which have provided more than 800 tons of blood for the front, hundreds of thousands of lives have been saved. Russia has not had epidemics during this war, despite the extreme conditions created by the evacuation of populations, transport of troops, and the great scale of military operations. Isolated outbreaks of typhus were quickly suppressed. The number of cases of typhus during this period has hardly increased and there are fewer cases of dysentery, measles, and scarlet fever than during the prewar period. Specialized hospitals have been widely distributed, making it possible to correct defects which disfigure the face, to preserve eyesight, and to restore hearing and the functions of the extremities.

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THE DIAGNOSIS OF PSYCHONEUROSIS

A special problem is occurring with increasing frequency in men returned from overseas, because of the extremely loose application of the diagnosis "psychoneurosis." Many of these men report that they have been told they have this illness and, in instances, that they will receive a discharge from the Army when they return to the United States. Some of them report that similar statements have been made by medical officers after they have reached the United States.

Because of the necessity to salvage every possible man for further military duty, even though limited to duty within the United States, strenuous efforts should be and are being made to accomplish that objective. Attempts at rehabilitation in the form of individual or group psychotherapy are extremely difficult, however, when patients who have been led to such a belief arrive in our general hospitals.

This attitude must be reversed if such men are to be salvaged. It is very important, therefore, that no such information or commitments be given these patients either in the theater or in hospitals in the United States, if they are to be transferred elsewhere.

A general hospital in North Africa. In foreground, nurses' tents; center section, wards and operation huts; in background are the quarters of enlisted personnel. Hospital was in use three weeks after work on it was started. All wards have concrete floors and are divided by concrete walks. Personnel consists of 500 enlisted men, 56 officers, 105 nurses.

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TYPHUS FEVER IN CIVILIANS IN ITALY

Although a relatively large outbreak of louse-borne epidemic typhus fever has occurred in Naples, to date only one case of typhus has been reported in an American soldier in Italy. Typhus fever, which had not occurred in Naples for fifteen years, is assumed, on evidence, to have been imported into Italy in 1943 by refugees from the Balkans and perhaps by escaped prisoners of war. The outbreak was under way before the Allied forces occupied southern Italy and Naples.

Removing a typhus fever patient from a house in Naples.

The outbreak has been brought under control with unusual promptness through vigorous measures instituted and carried out by the U. S. A. Typhus Commission working in association with the medical establishment of the Surgeon, North African Theater of Operations, AMG officials, and a typhus control team of the Rockefeller Foundation Health Commission. There was full cooperation from military authorities of the Peninsular Base Section and from Headquarters, U. S. Forces in the Middle East. All operations were carried out in constant contact with The Surgeon General and the Commanding General, A. S. F.

Typhus patient is put in Allied Forces' ambulance for transportation to hospital.

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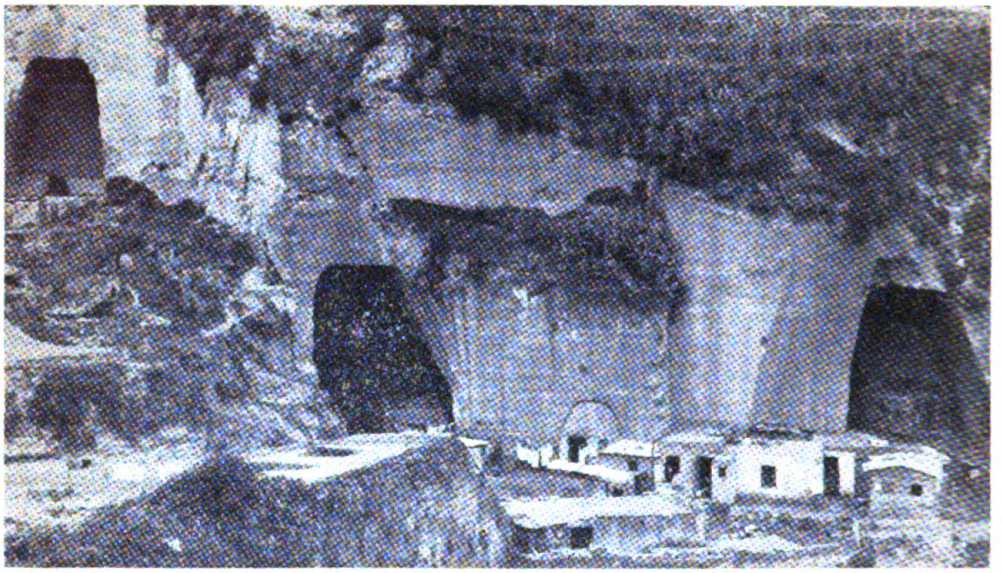

Entrance to caves and adjacent dwellings under a cliff in Naples. Natives were crowded in such shelters as these.

The typhus control program included case finding, immediate contact delousing of persons in contact with cases, general contact delousing of persons in vicinity of a case, mass delousing of entire population of Naples, and immunization with typhus vaccine administered first to personnel of all essential services, including doctors, nurses, hospital attendants, police, priests, and officials. It was possible to delouse

Shacks in which adults and children live in a cave in Naples.

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nearly one million persons in so short a time because of the development of new and effective chemical insecticides and new methods of applying these substances. While dependence for immediate control was placed on delousing, immunization with typhus vaccine was instituted as a factor for long-term control. Supplies of vaccine were moved from Cairo to Naples and, to replenish the stock at Cairo, vaccine was rushed from a medical supply depot in the United States.

More than a million people were dusted with louse powder. An officer uses a power duster to apply DDT to clothing and body of a civilian in an alley in Naples.

Typhus is endemic in all countries of North Africa, according to the *Bulletin of the Health Organization of the League of Nations*, 1943, Vol. 10, as abstracted in the *Bulletin of War Medicine*, June 1943. Epidemic conditions prevailed in 1937-38 in Morocco, Algeria, and Tunisia, and in the latter two countries the number of cases in 1941 was more than double those recorded in any of the previous twenty years. The cases were even more numerous in 1942. While isolated cases have been occurring in France among new arrivals from North Africa, it is said that typhus had spread only in the prisons of Marseilles in which more than 100 cases had occurred at the time of this report. The

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bulletin on louse-borne typhus in Europe referred to deals with the existing epidemiologic conditions, the possibility of an extension of the disease, and the steps that can be taken for its control by disinfestation and the use of vaccines.

BASIC ELEMENTS OF ACCIDENT PREVENTION

One fallacy of the theory and practice of safety springs from the idea that an industrial worker need only be taught industrial safety, that the farmer need only be taught agricultural safety, and the pilot need only be taught aircraft safety. The basis for safety is the same regardless of the type of safety considered and only by teaching all forms of safety can this basic factor be inculcated. The industrial worker who is not safe at home or on the road or in his garden will not be safe at work. If we were to attempt to teach pilots the basis of safety, we should first teach them the elements of safety at home, then on the road, on the farm, and in shops before we should attempt a complicated program of aircraft safety.

Eighty to 90 percent of all accidents can be prevented and a similar percentage of accidents has a personal factor which usually, in preventing aecidents, is associated with the mind of the injured person. He has made a judgment or a decision which has been incorrect or based on improper fact or he has made no judgment or decision and has acted solely on instinct, and the result has been an accident. If such is the case, the attack on accident prevention should come from this personal approach. Little thought has been given to the basic fact that no judgment or decision can be made without the lapse of time. An idea requires a fraction of a second for its production, because of the fact that the electrical-like transmission in nerves of necessity requires "time." We also know that two or more ideas are necessary for a judgment or a decision. It is obvious, therefore, that when an untoward incident occurs there must be a lapse of time, however short, before a judgment can be made as to a safe course. The housewife who drops a fork and leans down to pick it up may find that she has bumped her head on an open drawer in bending down. In order that a judgment might intervene, there must be a conception of the fallen fork and another of an open drawer. The two ideas require a fraction of a second apiece and the association of the two ideas another fraction, its length depending on training; therefore,

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some time must elapse before the housewife can make a judgment which may be the basis of a safe act. Forty-eight times out of fifty no accident will result because not all elements of an accident are present. But one accident following fifty incidents is too high a percentage. The meat cutter who loses only one hand every twenty years has a percentage loss which is too high.

If this line of reasoning were followed, fewer accidents would result from untoward incidents. One could be trained or train himself in the prevention of accidents by the thorough analysis of simple homely examples, as, the safe way to strike a match. This type of training reduces the time required to arrive at a proper decision when faced with an impending accident. It is one thing to train a pilot that is wise to hesitate for a fraction of a second in order to make a safe judgment or decision; it is another element of his training that he should know that one accident following fifty incidents is too high a percentage on which to take a chance. The soldier who dodges nine hundred and ninety-nine bullets is no better off if he does not dodge the next one. The result is the same as if he had not dodged the first one, except that he may have lived a little longer.

Anyone interested in being safe should be trained to hesitate at the right time and for the proper interval. For one to train himself to the conditions that make for safety, he should take the opportunity to practice safety many times a day; that is, to practice making safe judgments and decisions. The pilot who stops to pick up a safety pin around the home because a child might swallow it has paused to make a safe decision which will train him to make similar and more important safe decisions when a more important incident arises.

It seems so important that a person must stop and think at the right time that the following motto has been coined to summarize the situation: "A second of safety for Safety First." There are times when only the operation of instinct will prevent an accident. Under modern conditions such occasions are infrequent as compared with the situations in which a moment of hesitation will produce safety. Some accidents require only a "Stop!" for their prevention; others require "Stop and think"; in less frequent cases, "Stop, look, and listen" are necessary. In some cases a week of thought and preparation may be necessary to prevent an accident. The pilot or crew member who avoids accidents by instinct, intui-

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tion, or by guess is riding for a fall. (Extract from item by Lieut. Colonel Richard D. Mudd, Surgeon, Kelly Field, Texas. Submitted for publication in *News Letter* of the Air Transport Section, National Safety Council.)

NEW MOSQUITO VECTOR OF ENCEPHALOMYELITIS

Since the initial finding by Kelser in 1933 of the ability of mosquitoes to transmit equine encephalomyelitis, at least ten species of *Aedes* and one species of *Culex* are now known to be capable of transmitting the malady. The disease occurs not only in lower animals but also in man.

Recently in Trinidad a number of cases occurred among animals and two cases in human beings. The disease in Trinidad was studied by Major Richard T. Gilyard of the Army Veterinary Corps, who found that *Mansonia tittilans* is capable of transmitting the infection. This is the first demonstration of the ability of this genus of mosquito to convey the disease. Major Gilyard's article on the subject appeared in the April issue of The Bulletin.

PENICILLIN

Penicillin is becoming available in such increasing amounts that at present there is a sufficient quantity to treat all patients in which this form of therapy is indicated. Apparently the drug is not being employed as generally as its indications and usefulness demand. This is probably due to a lack of familiarity with penicillin and to the fact that until recently its use has been greatly restricted. To become familiar with the indications, routes of administration, and dosage of penicillin, medical officers should carefully study War Department Technical Bulletin TB MED 9, dated 12 February 1944.

As long as penicillin continues to be on automatic distribution, it can be obtained in a given medical installation in the zone of the interior by advising the surgeon of the service command of the estimated monthly requirement of the installation.

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DENTAL CLINICS IN TIME OF WAR

Dental service as under actual war conditions beneath camouflage nets while on desert maneuvers. This is a 2½-ton truck equipped with a home-made laboratory bench, two M. D. Chests No. 61, two M. D. Chests No. 62, and one M. D. Chest No. 60. Two dental officers are taking impressions for prosthetic appliances, while another dental officer is placing a filling.

Exterior of a Nissen hut in which is housed the dental clinic of an overseas general hospital. Main portion of dental clinic is in the room where the windows are seen.

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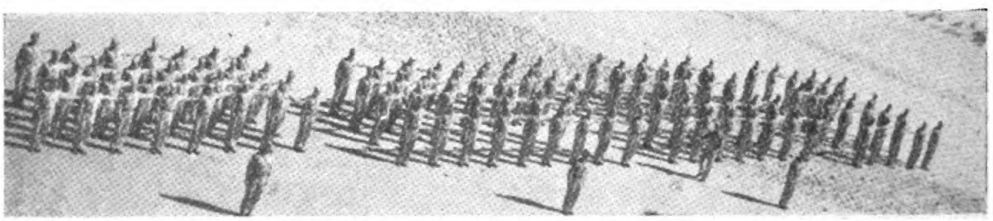
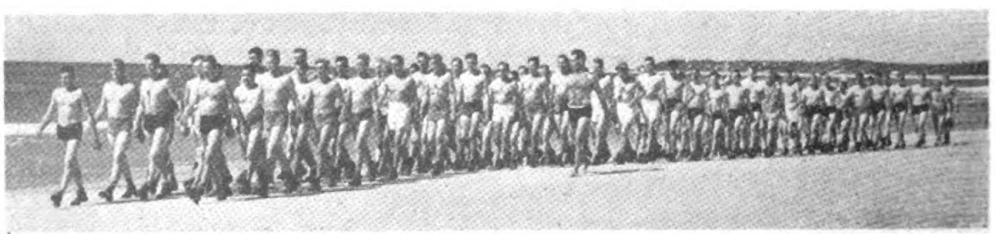
CONFERENCE ON RECONDITIONING PROGRAM

A two-day conference on the Army Medical Department's program for reconditioning sick and wounded soldiers was held at the Schick General Hospital, Clinton, Iowa, 21-22 March. Representatives were present from the War Department General Staff, headquarters of the Army Service Forces, the Military District of Washington, the nine service commands, and the Army general hospitals. The first day was devoted to touring the hospital to observe various aspects of the program designed to restore the sick or wounded to full physical and mental health, including those who will be able to return to duty and those who must be discharged for disabilities. Among the speakers on the second day of the conference were Colonel Augustus Thorndike, M. C., director, Reconditioning Division, Surgeon General's Office; Major William E. Barton, M.C., chief of the Blind and Deaf Rehabilitation Branch; Major William Briscoe, M. C., chief of the Educational Reconditioning Branch; J. J. McCloy, Ph.D., consultant in physical reconditioning; Mrs. Winifred Kahmann, chief of the Occupational Therapy Branch; and representatives of the Army's Special Services and Morale Services Divisions and the American Red Cross.



During the convalescent period following hospitalization, a casual group at a rest camp drills on a beach in New South Wales.



Casual company, convalescent battalion, march to the beach for a supervised swimming period. Australia.

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DIPHTHERIA

Attention has been directed previously to the prevalence of pharyngeal and cutaneous diphtheria in this theater. Additional data indicate that virulent diphtheria infections are more widespread than has been suspected. Pharyngeal diphtheria must be suspected whenever a soldier complains of sore throat. The original examination may reveal slight redness and edema in all of the throat and nothing to suggest the usual picture of diphtheria. Examinations must be repeated at frequent intervals. The occurrence of a dirty greyish exudate is an indication for the immediate intramuscular injection of 40,000 units of diphtheria antitoxin without bacterial confirmation. Strict precautions against anaphylactic shock must be rigidly employed.

Cutaneous lesions harboring virulent diphtheria organisms are a much more difficult and larger problem. Previously it was believed that tropical ulcers occasionally harbor virulent diphtheria organisms. Important studies carried out at a general hospital indicate widespread occurrence of virulent diphtheria organisms in a heterogenous group of skin infections. A wide variety of skin conditions—eczemas, acnes, paronychiae, tropical ulcers, trichophytidides, and many minor superficial dermatitides—were reported in this group. The clinical significance of the presence of virulent diphtheria organisms in specifically infected cutaneous lesions is attested to by the development of postdiphtheria neuritis, a complication which fortunately has been rare. While at present cutaneous diphtheria seems largely an epidemiologic problem, it is extremely important.

That all cutaneous lesions are thought to contain virulent diphtheria organisms is not inferred. In the study referred to, 26 percent of the skin cases harbored virulent diphtheria organisms, 25 percent avirulent diphtheroids, and the remainder a variety of organisms. The lesion most likely to contain *C. diphtheriae* is the typical tropical ulcer. The recovery of the organism from this and other lesions will depend on the number of cultures, the experience of the investigator, and the preparation of the lesion to be cultured. Heavily contaminated lesions will yield the organism readily, but in general a productive preliminary procedure consists of saline compresses to the lesion for from twelve to twenty-four hours.

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C. diphtheriae grow readily in broth media, on Loeffler's medium, and blood agar plates. For accurate identification, it must be obtained in pure culture. Fermentation reactions give a sufficiently reliable index of virulence for practical purposes. *C. diphtheriae* ferment galactose, dextrose, and maltrose, while sucrose and lactose remain unfermented.

Once *C. diphtheriae* have been recovered from a skin lesion or pharyngeal diphtheria has been diagnosed clinically, strict contagion isolation must be maintained according to existing regulations. Progress cultures must also be performed so that carriers may be kept under restriction.

About 38 percent of proved cases of cutaneous diphtheria when first seen are Schick positive. The comparatively slow absorption of toxin from the skin and the duration of infection are probably responsible for this. The present policy in this theater will be to treat with antitoxin only such cases of cutaneous diphtheria as are Schick positive. (Abstract of Circular Letter dated 4 January 1944 published at headquarters, office of the surgeon, in a Pacific theater of operations)

SHORTAGE OF NURSES, DIETITIANS, AND AIDES

Because of the critical shortage of nurses, dietitians, and physical therapy aides, personnel of the Women's Army Corps, both officer and enlisted, may be released from the Women's Army Corps for appointment in the Army Nurse Corps and in the Medical Department of the Army as dietitians or Medical Department physical therapy aides, provided that—

1. Request for release from the Women's Army Corps and for appointment in the Army Nurse Corps or other branches of the Medical Department is initiated by the individual concerned and approved by the Director of the Women's Army Corps.

2. The applicant is fully qualified, both professionally and physically, for such appointment as determined by The Surgeon General.

3. In the event of release from the Women's Army Corps, the applicant will be immediately appointed in the Army Nurse Corps or other branches of the Medical Department in accordance with her qualifications.

All applications for appointment in the Army Nurse Corps and other branches of the Medical Department of the Army under the provisions of this circular will contain—

1. Full information as to professional qualifications.

2. Report of physical examination, final type, rendered on W.D. A.G.O. Form No. 63 (Report of Physical Examination).

Appointment will be made in grade of second lieutenant only.

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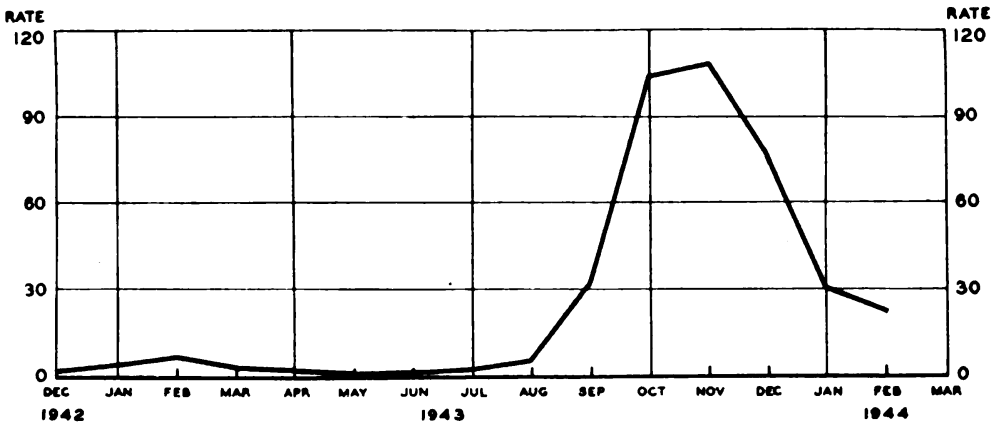
HEPATITIS IN NORTH AFRICA

During the late summer and fall of 1943 an epidemic of mild infectious hepatitis with jaundice (also called catarrhal jaundice and jaundice without known cause) occurred among United States, British, and French troops in the North African Theater. Similar outbreaks were experienced by British troops in the Middle East in 1941 and 1942. A study of the incidence of infectious hepatitis among troops in the U. S. over the past ten years (excluding the 1942 experience with post-vaccinal hepatitis) reveals that admissions for this disease tend to increase during the late summer, reaching a peak in November and December and then falling off sharply to an average level of about 1 per 1,000 per annum. In the southern



hemisphere, in regions which in general have seasons reciprocal to those in this country, the peak incidence of infectious hepatitis occurs during those months which correspond to our autumn.

Admissions from jaundice in the North African Theater, which has seasons corresponding in general with those in the United States, began to increase in August and September, reached a peak in November, and then began to fall off sharply. Reports indicate that the admission rates have continued to decrease markedly during the months of January and February 1944.

While the etiology of infectious hepatitis is not known, it is believed to be caused by a filtrable virus. The ordinary mode of infection is not known but the disease is thought to spread under usual circumstances by droplet transmission from an infected respiratory tract. The incubation period is believed to be about one month. There are no definite pre-

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ventive measures at present. During an outbreak of infectious hepatitis good sanitation and hygiene should be practiced as well as the precautions usually taken to prevent the spread of respiratory diseases.

Clinically, the disease has been frequently characterized at onset by a mild upper respiratory infection with slight fever, sometimes accompanied by diarrhea, following which a latent period of from several days to a week may ensue. Then the patient begins to complain of malaise, lassitude, anorexia, epigastric distress, back pain, and gaseous distension and may also exhibit urticaria and transient pains in the joints. During this prodromal period, which may also last several days, the urine is darker than normal and frequently shows a positive foam test for bile. Physical examination shortly thereafter reveals some enlargement of the liver and icterus ranging from a slightly yellowish tint of the sclerae to severe jaundice of the skin and mucus membranes. The enlargement of the liver may increase and the patient may be quite ill. The acute stage generally persists for about one week and is followed in some cases by quick recovery, but more often by a prolonged convalescence of from two to six weeks. The mortality in North Africa has been extremely low. Treatment has been largely symptomatic with bed rest, a high protein and carbohydrate, low fat diet supplemented with vitamin concentrates and the administration of parenteral fluids where indicated.

Intensive investigations of jaundice have been carried out since 1942 under the direction of The Surgeon General. Several Commissions of the Board for the Investigation and Control of Influenza and Other Epidemic Diseases in the Army are continuing to investigate the cause, manner of spread, treatment, and control of infectious hepatitis. Work along these lines has been carried out in this country and abroad. In addition, Army hospitals and laboratories, including the Army Medical Museum, have been concerned with study of problems of jaundice. The U. S. Public Health Service, one of the Commissions under the Board, and British investigators in the Middle East and in England have shown that infectious hepatitis is transmissible by injections of blood serum from individuals suffering with the disease either in clinical or subclinical form.

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NEW CHEMICAL PROPHYLACTIC KIT

The basic requirements of an individual chemical prophylactic against venereal disease are protection against infection, simplicity, absence of irritating qualities, and aesthetic acceptability to individuals. The mobility of modern armies and the wide dispersion of troops in warfare has demonstrated the limited usefulness of regularly established prophylactic stations. It has also been shown that the two-tube individual chemical prophylactic packet currently used is neither simple to use nor good protection against chancroid. It has never been fully acceptable to the individual because of discomfort after use and messiness.

The Army is now conducting field trials with several types of single-tube individual chemical prophylactic packets. The most satisfactory of these trial ointments contains 30 percent calomel and 15 percent sulfathiazole (micronized) incorporated in a special vanishing-cream type of base. Reports to date from the field study include 6,732 individual prophylactics given, using this formula. The method of administration consists of urination, thorough washing of the genitalia and adjacent areas with soap and water, injection into the urethra of one-fourth of the 5-gram tube of ointment, and massage of the remainder into the skin of the penis, scrotum, and surrounding areas. No protective covering of the genitalia is needed since the ointment rubs in well and does not soil underclothing. In this series 9 failures are recorded, 3 individuals developing syphilis and 6 gonorrhea, giving a failure rate of 0.13 percent, which compares very favorably with other methods of chemical prophylaxis. The new kit has been favorably received by individuals who used it, and prophylactic rates in general have been much improved. Among several thousand persons carefully observed, no evidence of local or systemic reactions following the treatment was found.

As a result of these trials and of information obtained from the Navy and civilian sources on the effectiveness of similar types of ointments, it is planned to replace completely the old double-tube kit as soon as the new single-tube prophylactic can be procured in sufficient quantities. While initial distribution probably will begin in June, several months may elapse before present stocks of the older kit are exhausted.

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DANGER OF DEEP BREATHING IN PRESENCE OF THROMBOPHLEBITIS OR PHLEBOTHROMBOSIS

The most important factor in the mechanism of the return of blood to the heart from the peripheral veins is probably that of respiration. Deep breathing produces a marked increase in the downward gradient of pressure and hence the effect of suction. In the presence of a thrombus which is loosely attached or which has a long tail waving in the lumen of a vein, suction which tends to loosen or to break the thrombus is accompanied by grave danger of pulmonary embolism. It is of the utmost importance, therefore, that wherever thrombophlebitis or phlebothrombosis is suspected or established, deep respiration should be avoided.

When a patient has experienced a sharp pain in the chest and has expectorated bright red blood a few days postoperatively or in the presence of thrombophlebitis, the diagnosis of embolism is likely and the location largely academic. There is a strong risk of recurrent emboli and this is markedly increased by deep breathing. The common practice of having the patient breathe deeply or cough during the physical examination of the chest should be omitted. Death has occurred during and immediately after such examinations.

While ligation of a vein proximal to a recognized site of thrombosis may reduce the risk of pulmonary embolism, it does not justify disregard of the danger inherent in forced respiration. It should be remembered that not infrequently, unrecognized thrombi exist in other sections of the venous system. If additional information regarding the status of the lungs is desired, it may be obtained by cautiously sliding an x-ray cassette under the thorax and taking a bedside film.

AMERICAN BOARD OF ORTHOPAEDIC SURGERY

Applications to take Part I of the examinations must be in the hands of the secretary, Dr. Guy A. Caldwell, 3503 Prytania St., New Orleans 15, Louisiana, on or before 1 August 1944. The examinations will be give in New Orleans, New York, Chicago, and San Francisco, during the latter part of September and early October, the dates to be announced later.

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REHABILITATION OF THE BLIND

Announcement has been made of a new plan for the rehabilitation of the blind which will extend the services now being offered by the Medical Department of the Army at the Valley Forge General Hospital and the Letterman General Hospital. Under the present plan all newly blinded casualties are to be reported promptly to The Surgeon General's Office. When it is not possible to effect an immediate transfer of the blinded patient to one of the two centers designated for their care, a blind consultant is dispatched to the hospital of residence in order to make early contact with the disabled serviceman. At the earliest time at which the blinded patient is able to travel safely he is sent to one of the two centers where both sighted workers and blind instructors begin the process of retraining simultaneously with medical and surgical treatment. As soon as the soldier no longer requires active therapy, he is transferred to a center adjacent to the Valley Forge General Hospital where his social adjustment training and pre-vocational training may continue.

Much misinformation about blindness has been given wide circulation; for example, it has been said that thousands of service men have been blinded and that a gigantic program to breed dogs to guide them will be necessary. U. S. Veterans' Administration figures show about 300 pensioners with service-connected visual loss as a result of World War I. One hundred seventeen cases of blindness, arising from World War I, were cared for in the rehabilitation center at General Hospital No. 7, known as Evergreen. Sixty-five of these soldiers were totally blinded. So far in World War II, 288 British service men and civilian casualties have been at Saint Dunstan's, renowned agency for the care of the blind, in Great Britain. The Veterans' Administration reported for this war, as of January 1944, 99 veterans with some degree of blindness exclusive of loss of one eye; of 86 discharged with blindness from the Army, only 17 were totally blind. As of the first of March, 73 blind were registered with The Surgeon General's Office; in addition, two blinded prisoners of war were under treatment.

Blindness is said, by Army definition, to exist when the best corrected vision is 20/200 in the better eye.

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GUIDE DOGS

Some blinded persons will develop the ability to get about with a minimum of assistance, and with a skillfully used cane they will be inconspicuous and unencumbered; others will find it desirable to have a guide dog. About 10 percent of the blinded, or seven men, have thus far secured guide dogs. The blind veteran should not acquire a guide dog until he has completed his social adjustment training to the point where he has become as independent and self-reliant as possible; then a guide dog should be secured when it has been shown to be the best solution of the problem.

Private agencies have made available training for blinded soldiers in the use of a dog and will provide the dog for the nominal fee of $1.00 or at no cost to him. Existing civilian guide dog agencies, it is believed, will be able to handle the problem of providing needed guide dogs where indicated, without Federal assistance.

On 8 January 1944, the following report was forwarded to The Surgeon General by the President's Committee on Rehabilitative Measures to be carried on by the War and Navy Departments with respect to blinded service men prior to discharge from the service. The report carried the signatures of Henry L. Stimson, Secretary of War, Frank Knox, Secretary of the Navy, Paul V. McNutt, Chairman, War Manpower Commission, and Frank T. Hines, Administrator of Veterans' Affairs. It was approved by the President of the United States.

A summary of the report follows:

It is considered that a plan for the vocational rehabilitation of blind veterans following their discharge from the armed forces should be based on social adjustment training as follows:

Social adjustment training should begin as quickly as possible after it has been determined that the patient will be blind. Therefore, each blind person should have such social adjustment training during hospitalization as may be feasible. However, it is believed that few of such persons at the time of discharge from the hospital will have received all of such training that is necessary to enable them successfully to pursue vocational training or employment following vocational rehabilitation. It would be hardly feasible, if not impossible, to provide all of such training during hospitalization, and many patients will not remain long enough under medical treatment to complete all of the social adjustment training that is necessary even if it were available.

When a blind person has reached the maximum benefit from hospitalization, he should continue such social adjustment training as may be necessary to enable him to undertake with confidence a course of vocational training

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and to pursue same to a successful conclusion—satisfactory employment. In order to apply this principle effectively, the social adjustment training should be completed before the blind person is discharged from the service.

The Veterans' Administration, before the person has completed his social adjustment training and prior to his discharge from the service, should arrange for each blind person a course of vocational rehabilitation to be pursued after discharge.

A long-continued residence in institutions for the blind must be avoided. However, a short association with other veterans having the same disability will be of value to the newly blinded veteran.

The length of time which may be required to adjust the blind veteran to a point where he will be capable of undertaking vocational training will be different in each case depending on a number of factors. However, no veteran should be permitted to remain beyond the time when he has made the best adjustment he is capable of making—in most cases not exceeding four months.

The following subjects which should form the basis for social adjustment training should be developed into definite and specific courses and each trainee should be given as much instruction in each as is found to be necessary. The activity of each veteran after admittance should be scheduled so far as feasible for every hour of the day and he should be required to attend regularly: mental adjustment as may be necessary to develop a proper attitude and a will to overcome his handicap; use of the Braille watch; use of the Talking Book; perception of objects by sound; recognition of people; use of the cane; how to get about indoors and out of doors; assistance with personal problems, shaving, eating, posture; pencil writing; typewriting; Braille reading; Braille writing with slate and machine; aid in learning how to study; hand training; hand tools, machine tools; use of leisure time—games, checkers, cards, theaters, parties, dancing, and such sports as may be feasible (not for vocational purposes).

Recommendations

1. That social adjustment training should begin as early as possible after determination has been made that the patient will be blind: Each blind serviceman during his period of hospitalization shall be given such portions of a well-organized course of social adjustment training adapted to his particular case. Accordingly, the social adjustment training as now practiced by the War Department, at the Letterman General Hospital and the Valley Forge General Hospital, will be continued and extended as may be necessary.

2. That when a blinded patient has reached maximum benefit from hospitalization, he shall continue the course of social adjustment training contemplated in recommendation No. 1 as may be necessary to enable him to undertake with confidence a course of vocational rehabilitation training under the provisions of Public Law 16, 78th Congress, and to pursue same to a successful conclusion—satisfactory employment.

3. That social adjustment training shall be completed before the veteran is discharged from the service and to that end the War and Navy Departments will retain in the service personnel blinded in World War II until

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their social adjustment training shall have been completed as contemplated under recommendation No. 2 except in particular cases in which it is determined that social adjustment training is not feasible.

4. That the Veterans' Administration shall initiate and complete as early as possible within the social adjustment training period the vocational advisement of each case to the end that as early as possible during his social adjustment training the blind person will know precisely his plans for the future, including not only his ultimate vocational objective but also the vocational training program by which the objective is to be attained.

5. That with a view to making practicable and facilitating the carrying out of recommendations Nos. 1, 2, and 3, all blinded personnel of the Army and Navy shall be the responsibility of the Army Medical Department, in facilities to be made available by the Army. In view of the fact that the Army is taking over this responsibility, this adjustment will be carried out under the direction of The Surgeon General of the Army and the necessary funds to put into effect this additional responsibility will be made available as the Secretary of War directs.

6. The details of the arrangements necessary to carry out these recommendations will be coordinated by the Medical Department of the Army with the Navy Department and the Veterans' Administration.

HOSPITALS BOMBED IN ITALY

The War Department announced 4 March that five officers of the U. S. Army Nurse Corps were killed or died of wounds received in the bombing of field hospitals on the Anzio beachhead in Italy on 7 February and 10 February. These were the first women in the U. S. Army killed as a direct result of enemy action in this war: First Lieut. Blanche F. Sigman, East Akron, Ohio; First Lieut. Carrie T. Scheetz, Camp Hill, Pennsylvania; First Lieut. Glenda Spelhaug, Crosby, North Dakota; Second Lieut. Marjorie Morrow, Audubon, Iowa; Second Lieut. LaVerne Farquhar, Sidney, Texas. Three other nurses were slightly wounded in these bombings.

The *Washington Post* published an I. N. S. release dated 22 March, stating that Nazi artillery batteries had shelled the American hospital area on the Anzio beachhead in Italy killing five patients and wounding ten other patients. Two shells scored direct hits on a ward, causing all of the casualties. Two shells hit the officers' ward injuring no one. Two shells hit the chief nurse's tent, but she was not injured.

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AMEBIC ABSCESS OF TRANSVERSE MESOCOLON

Major Harlis O. Bolling, M.C., reports a case of amebic abscess of the transverse mesocolon at a station hospital in a tropical country where amebic dysentery is fairly frequent. A soldier, 30 years of age, entered the hospital on 15 May 1943 with epigastric pain, which was constant, moderately severe, and radiated through to the back. His symptoms subsided and he returned to duty in one week, but was readmitted on 29 May because of sudden, acute distress in the epigastric region, radiating through to the back, accompanied by nausea and vomiting. The pain was the same as on the first admission but much more severe. He had not been ill previously and the family history was negative. On examination the patient was considered a surgical emergency. His temperature was 103° F. and the leukocyte count was 18,750. His abdomen was rigid in the upper part with point tenderness to light pressure 3 cm. above the umbilicus.

Eight hours after admission, exploratory laparotomy was done under ether anesthesia through an upper abdominal midline incision. A mass 10 cm. in diameter was encountered lying between the stomach and the transverse colon, anterior to the pancreas, and in the transverse mesocolon. Many thick adhesions extended out to the stomach and the transverse colon and down to the pancreas. A needle was inserted into the mass and thick necrotic material aspirated. A wedge-shaped biopsy taken from the mass exposed a central cavity filled with necrotic material. A rubber drain was inserted in the biopsy opening and brought out through the upper part of the abdominal wound.

No parasites or ova were found in the aspirated material and a Gram stain revealed no organisms. Wright's stain demonstrated a large number of degenerated polymorphonuclear cells. Sections from the biopsy revealed two large bodies in the granulation tissue which had the appearance of the trophozoite of *Endamoeba histolytica.*

The patient did well after operation for four days, then developed a bloody diarrhea with frequent small stools and severe abdominal cramps. Warm stool specimens now contained many trophozoites of *E. histolytica.* On the fifth postoperative day the abdominal wound was dressed and warm slide preparations from the drainage contained many trophozoites of

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E. histolytica. Emetine and carbarsone treatment was instituted and the diarrhea was readily controlled.

On 11 July 1943 he had attacks of abdominal pain and cramps, this time in the region of the ascending colon. He had no diarrhea and all stool specimens were well formed and negative for *E. histolytica;* proctoscopic and x-ray studies were negative. Another course of emetine and carbarsone was given and the patient rapidly recovered. Since then he has continued to gain weight and do well. He was sent to a general hospital on 27 August 1943 for further observation and in fourteen days was discharged to duty without any evidence of *E. histolytica* infection. Six months have elapsed and the soldier continues his duties without any symptoms.

POISONOUS FISH IN THE MARSHALL ISLANDS

Fish poisoning occurs frequently among the natives of the Marshall Islands. There are three groups of poisonous fish in the islands (1) those which poison by biting or stinging; (2) fish having definitely poisonous flesh; and (3) fish having doubtfully poisonous flesh. The morays or tropical eels comprise the first group. They have hollow teeth through which venom is injected into the wound. The venom is hemolytic and large doses produce almost instantaneous death; smaller doses cause rapid, embarrassed respiration, violent cramps, and convulsions. Other fish have poisonous glands connected with dorsal and lateral spines. In this general group are the stone fish, toad fish, weever fish, zebra fish, and others. The flesh is not poisonous. The stingray (*Trygonidae*), "the queen of the sea-bottom," is most dreaded. It basks in shallow water and when stepped on inflicts serious wounds with its long, whiplike tail which has a bony spine. The poisonous jellyfish found here cause pain, and in a few instances deaths have resulted from their sting. Some species of coral have tentacles which inject poison.

Many of the second group of poisonous fish in the Marshall Islands are members of the family Tetrodon. They are commonly known as puffer or bladder fish. Porcupine fish are in this group. Their poison, which exists chiefly in the ovaries and testes, has a physiologic action somewhat like curare. These fish may cause poisoning at one time and not at another. Poisoning occurs particularly during spawning.

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In the third group, the doubtfully poisonous fish, the poison probably is due to bacterial decomposition. In this group are the box, cow, trunk, and parrot fish, barracuda, red snapper or red bass, file, trigger, and groper fish. The goat fish is sometimes poisonous; eating its head should be avoided. In fact, the head, liver, kidneys, ovaries, and testes of poisonous fish contain more poison than other parts of the body. Instances are recorded in which natives have been poisoned from eating fish caught in certain areas and have not been poisoned from eating the same kind of fish caught in other areas. Rock fish, as a rule, are poisonous while shoal and deep-sea fish are not poisonous.

ABANDONING SHIP

The U. S. Navy has published a booklet, entitled Survival on Land and Sea, which contains the main things that a man should know about living in wild countries and wild places. In the section on "Abandoning Ship," it is said that one should wait until the ship comes to a stop, try to get away in a lifeboat, and jump only when it is impossible to go down a hose, line, cargo net, or ladder. Remember to put on your gloves and go down hand-over-hand. Don't slide and burn your hands! You'll need them later. If it is necessary to jump, get rid of your steel helmet first, and then hold your nose and jump as far out as possible, hitting the water with your knees bent, your legs together and pulled up against your stomach.

If you have a cork life jacket, throw it over first and jump after it. Don't wear it when you jump or it may knock you out. If you have a pneumatic rubber jacket and are a good swimmer, jump in before you inflate it and swim as far away from the ship as seems safe before you do. If you are wearing a kapok life jacket, be sure the lower drawstring is drawn tight and tied securely before you jump.

If you have to go overboard without lowering a boat or raft (in anything but a flat calm), go over the weather or windward side. The reason for not going over the lee side is that any wind will drive a drifting ship down on you. Take care not to be washed back aboard if a sea is running. To avoid this, leave the ship by the bow or stern, whichever is lower in the water. If the propellers are still turning, leave by the bow. Swim hard to get away from the ship and around the bow or stern. When beyond concentrated oil or other dan-

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gers, relax and swim or paddle slowly toward the nearest floating object or mass of survivors. It is well to figure out where you want to go in a general way before you go into the water, because you can see much more from the deck than you can when you are swimming.

If fuel oil has been discharged, avoid it as much as you can by keeping head and eyes high and your mouth closed. Swallowing oil will make you sick and, if it gets in your eyes, will inflame them for a few days. However, serious effects have seldom resulted from contact with oil in the sea. Wounds which have come in contact with fuel oil have shown no delay in healing.

Should you have to jump from the ship into burning oil, you may, if you are a good swimmer, avoid being burned by the following procedure. It has been tested and has proved successful. Jump feet first through the flames. Swim as long as you can under water, then spring above the flames and brèathe, taking a breast stroke to push the flames away; then sink and swim under the water again. Men have been able to get through 200 yards of burning oil in this way. To do it, however, you will have to remove your life belt and other cumbersome clothing.

Obviously a seagoing man should *take every opportunity to learn to swim.* However, not losing your head is apt to be as important as knowing how to swim. Your life jacket will float you and all your clothes. Many men have been drowned through losing their heads and thrashing about in the water. Do not exhaust your strength by shouting or swimming about uselessly. Swim or paddle slowly toward a lifeboat, raft, or any floating object that will support you. *The danger of injury from underwater explosion is lessened by swimming or floating on your back.* When you reach a raft, if depth bombing is going on, sit or stand up on it; do not lie prone upon it.

OPTOMETRISTS

Complaint has been made to the Office of The Surgeon General that a number of optometrists in the Medical Department have not had a chance to go to officer candidate school because their commanding officers could not spare them from their technical duties. Such enlisted men should have the same chance to qualify for officer candidate schools as any other enlisted men of the Medical Department, provided they have the necessary qualifications.

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CARDINAL SINS OF WAR SURGERY

Major General W. H. Ogilvie, consultant surgeon to the British Forces in the Middle East, who recently visited the United States, has outlined the seven cardinal sins of war surgery as follows:[1]

1. Unnecessary operations on through and through bullet wounds of soft parts. The majority of these with rest and sulfonamide heal rapidly and leave no disability; operation means loss of time and loss of function.

2. Removal of skin. Skin is of all structures the most viable, the most resistant to infection, the most irreplaceable. It may be split, to give access to deeper structures, but never excised except, as in the edges of head or abdominal wounds, as a preliminary to suture. Circumcision of entry and exit wounds is the hallmark of the novice.

3. Wide excision of muscle especially transverse section of muscle groups to expose a track. The subsequent disability is shocking and quite unnecessary. Trimming, draining, and sulfonamides give equal safety.

4. Insufficient slitting of fascia. While excision is destructive, relief of tension is lifesaving. The tough fibrous sheaths of thigh and calf should be divided freely when a deep lacerated wound is being trimmed.

5. Tight plugging. No surgeon admits to this sin; all commit it at times. A man whose wound has been plugged arrives very ill and is relieved as soon as the deep pus is uncorked by pulling out the gauze that retains it. The only safeguards are free incision in muscle planes and single sheets of vaseline gauze laid in loosely.

6. Unsplit plasters. Closed plasters give trouble so seldom in hospital that surgeons find it difficult to realize their dangers in transport. An unpadded case owes much of its value to the control of circulation given by even pressure. But jolting in an ambulance car or train may start small hemorrhages or swelling in a recently injured limb, leading to an increase in volume small in itself but sufficient inside a closed case to cause a dangerous embarrassment to the circulation. We have been forced to issue an order that every lower limb

1. Circular Letter No. 7, 11 November 1943, by Colonel F. S. Gillespie, R.A.M.C., British liaison officer, Medical Field Service School, Carlisle Barracks, Pennsylvania.

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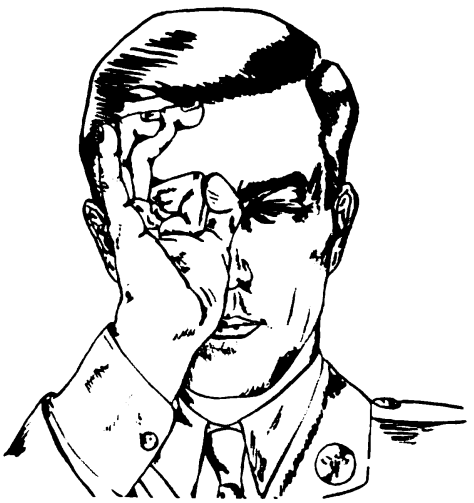
plaster must be split before evacuation, and we have tended to abandon the unpadded case and use padded plasters or standardized methods of fixation such as the Tobruk plaster for the lower limb and the Alamein or thoraco-brachial plaster for the upper.

7. Unnecessarily mutilating operations for gas casualties. Infection of subcutaneous or connective tissue planes of gas-forming Clostridia has been fairly common, particularly in more recent fighting; gas gangrene has been relatively rare, not often leading to loss of life or even necessarily of a limb. The reasons for this are many, but two things are particularly important: first, that all surgeons should know the kind of injury that is likely to develop gas gangrene—the lacerated wound of a large muscle mass complicated by injury to a main vessel—and should give the patient a prophylactic dose of serum and flag his documents so conspicuously that the danger will be appreciated at each surgical center he reaches; second, that all surgeons should know that gas is the least important sign in gas gangrene; pain, a rising pulse, a deadhouse smell, and solid edema in the limb mean much more. Today when so many cases even of gangrene recover after drainage or excision of muscle groups, no surgeon should amputate a limb for this cause if he has any opportunity of discussing the prognosis with a more experienced officer.

EMERGENCY VISUAL AID

Far- and nearsighted persons who find themselves in situations in which an expedient may be necessary may use the principle of the pinhole camera temporarily for the improvement of vision. A convenient and simple method of creating the small aperture required is by flexing the index finger as illustrated.



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MEDICAL DEPARTMENT TRAINING FILMS AND FILM STRIPS

The provision of adequate visual training material is a keynote to efficient, high-speed Army instruction. No service has had a more fundamental contribution to make to the training of the soldier in matters vital to combat effectiveness than the Medical Department. Because of this relationship to basic training subjects, the Medical Department visual aids have enjoyed a high frequency of use.

During the past twelve months, many additions and revisions to the Medical Department training film and film strip program have been made, and there has been constant improvement in the photographic quality and the teaching value of these aids.

These training films and film strips are available to military personnel by requisition to Signal Corps film libraries and sublibraries in posts, camps, and stations, overseas and in the zone of the interior.

The following list comprises the items particularly recommended:

Training Films

Available:

No.	*Title*
TF 8-999	The Fly.
8-1000	The Louse.
8-1174	Purification of Water.
8-1179	Disposal of Human Waste.
8-1180	First Aid for Chemical Casualties.
8-1238	Sex Hygiene.
8-1288	Louse-Borne Diseases.
8-1297	Personal Health in Snow and Extreme Cold.
8-2047	First Aid for Battle Injuries.
8-2049	First Aid for Non-Battle Injuries.
Misc. Film 157	"The Mosquito," by Walt Disney.

In production:

TF Proj. No. 7148	Personal Health in Jungle Warfare.
TF Proj. No. 7146	Venereal Diseases.
TF Proj. No. 7185	Regimental Medical Detachment in Combat.
TF Proj. No. 7211	Reconditioning.

Film Strips

Available:

No.	*Title*
FS 8-50	Application of the Army, Half-Ring, Hinged, Leg Splint.
8-51	The Reconstitution and Use of the Standard Army-Navy Package of Normal Human Plasma, Dried.
8-52	Mess Improvement, Part I.
8-53	Mess Improvement, Part II.

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8-54 Animal Diseases: Prevention, First Aid, Emergency Treatment.
8-55 Classes and Grades of Poultry.
8-56 Types and Forms of Cheese.
8-57 Venereal Disease—V. D.
8-58 Venereal Disease—Prophylaxis.
8-59 Venereal Disease—Control.
8-60 Disposal of Waste.
8-61 Mess Sanitation.
8-62 Water Supply and Purification.
8-63 Housing and the Control of Respiratory Diseases.
8-64 Control of Insect-Borne Diseases.
8-65 Chemical Warfare Injuries, Prophylaxis and Therapy; Part I—Lung Irritants.
8-66 Chemical Warfare Injuries, Prophylaxis and Therapy; Part II—The Vesicants.
8-67 Chemical Warfare Injuries, Prophylaxis and Therapy; Part III—The Vesicants.
8-68 Chemical Warfare Injuries, Prophylaxis and Therapy; Part IV—Miscellaneous Agents.
8-69 First Aid for Combat Injuries.
8-70 First Aid for Non-Combat Injuries.
8-71 First Aid: Transportation of Casualties.
8-73 Medical Supply.
8-74 The Morphine Syrette.
8-75 Medical Service of the Infantry Division: Part I—Medical Detachments.
8-76 Medical Service of the Infantry Division: Part II—The Medical Battalion.
8-77 Common Military Vehicles as Patient Carriers.
8-78 Ambulance Loading and Unloading.
8-80 The First-Aid Kit for Chemical Casualties.
8-81 Ward Management and Nursing, Part I.
8-82 Ward Management and Nursing, Part II.

In production:

8-79 Anatomy and Physiology, Instructional Charts.
8-85 Physical Therapy in the Treatment of Amputations: Part I—Massage, Exercise, and Bandaging.
8-86 U. S. Army Field X-ray Equipment, Part I—Table Unit (Item 96145), Unpacking and Assembly.
8-87 U. S. Army Field X-ray Equipment, Part II—Assembly and Adaptations of Field Table Item 96145 with X-ray Machine, Item 96085.
8-88 U. S. Army Field X-ray Equipment, Part III—Mobile Base and Tubestand Assembly (Item 96090).
8-89 U. S. Army Field X-ray Equipment, Part IV—Transformer Tube and Control Assembly (Item 96085 with Item 96090).
8-90 U. S. Army Field X-ray Equipment, Part V—Combination Table and Machine Unit Assembly (Item 96215).

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PROCEDURES FOR SELECTING MEDICAL, DENTAL, AND VETERINARY TRAINEES

The War Department has announced that soldiers who remain in the Army Specialized Training Program after 1 April 1944 will be primarily those assigned to courses in medicine, dentistry, veterinary medicine, and advanced engineering. Enlisted men now assigned to the program for instruction in medicine, dentistry, and veterinary medicine will be continued in the program. Also, A.S.T.P. soldiers currently enrolled in preprofessional courses will be continued in those studies and, on successful completion of that work, will be advanced to the medical or dental phase of the program. Assignment to training in medicine and dentistry in the A.S.T.P. for the remainder of the year will be made from among enlisted men who prior to 1 April 1944 have been accepted for 1944 classes in contracting medical and dental schools.

Civilians now in medical or dental schools and those who have been accepted for a 1944 class in an accredited medical or dental school but who did not receive a call for induction prior to 1 March 1944 will not be assigned for A.S.T.P. training in medicine or dentistry. Selection for preprofessional and subsequent professional training in medicine and dentistry will be restricted to soldiers who have completed their basic military training and have accomplished one of the following:

1. Passed an aptitude test for medical profession upon successful completion of Term 2 or Term 3 in the Army Specialized Training Reserve Program.

2. Received a satisfactory score in the Army-Navy (A-12, V-12) College Qualifying Test (men in this group must have satisfactorily completed at least a year of premedical or predental studies as civilians).

Priority will be given in the order as outlined. Any additional vacancies may be filled by soldiers selected on the basis of their proved abilities and academic background.

Shoes for Soldiers.—The War Department announced on 24 January that soldiers in combat areas are receiving on an average 3½ pairs of shoes a year, as compared with a previous figure of about 5 pairs. Soldiers stationed in continental United States are issued slightly fewer than 2 pairs of service shoes a year. Improvement in design and manufacturing methods is credited with the decrease in the number of shoes issued annually to soldiers in combat areas overseas.

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RECENT DIRECTIVES AND PUBLICATIONS OTHER THAN S.G.O.

This list is intended as only a brief reference to the items mentioned. Before acting on any of them, the original communication should be read and request for copies, when made, should be directed to the source of the communication through proper channels.

W. D. Circular 99 9 March 1944	Medical Corps Officers.—Changes various T/O to permit broader employment of M.A.C. officers to effect economy in utilization of M.C. officers.
W. D. Circular 97 8 March 1944	Wills of Military Personnel.—Recommends that every person in military service give consideration to advisability of making a will. Sets forth responsibility of C. O.; means of obtaining legal assistance; and manner of executing will.
W. D. Technical Bulletin TB MED 16 6 March 1944	Penicillin Treatment of Resistant Gonorrhea.
W. D. Circular 93 3 March 1944	Officers ordered to General Hospitals.—Rescinds Par. 15, W. D. Classif. Memo. No. 15, 19 Nov. 1943, and related directives. When officer is ordered to general hospital, W. D., A.G.O. Form 66-1 to be forwarded to general hospital. On release of officer from hospital, C. O. of hospital will forward Form 66-1 to C. O. of pool of arm or service to which officer is assigned, or to headquarters of installation to which officer is permanently assigned.
W. D. Circular 90 29 Feb. 1944 Sec. III	Commanders will instruct military and civilian personnel to refrain from discussion regarding secret weapons, military operations and plans, and movements of troops and ships.
W. D. Circular 84 24 Feb. 1944 Sec. III	Insecticide.—Pending revision of W. D. Circ. No. 239, 1943, "Insecticide, aerosol, 1-pound dispenser," is authorized for issue to hospitals of U. S. Army transports and hospital ships embarking from P.O.Es. where there is risk from mosquito-borne diseases.
W. D. Circular 81 23 Feb. 1944 Sec. IV.	Hearing aids will be furnished by Med. Dept. to personnel suffering from hearing defects which preclude performance of military duty. Prescribing and fitting of hearing aids limited to Deshon Gen. Hosp., Borden Gen. Hosp., and Hoff Gen. Hosp. Rescinds Sec. VI, W.D. Circ. 192, 1943.
W. D. Technical Bulletin TB MED 11 22 Feb. 44	Influenza.—Suggestions re treatment and handling of military personnel during influenza epidemics.
W. D. Memo. W605-44 21 Feb. 1944	Retention for Limited Service.—Rescinds letter AG 210.85 (28 Oct. 43) PO-S-A, 1 Nov. 43, as amended 13 Jan. 1944. Officers incapacitated for active service but recommended by Retiring Board for limited service, to be handled as indicated.

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A.S.F. Medical Supply Catalog Med 4—15 Feb. 1944	Medical Supply Catalog.—Supersedes Circ. No. 26, S.G.O., 1 Dec. 42, including changes thereof. Contains individual and organizational tables prescribing basic allowances of expendable medical supplies not otherwise authorized. Prescribes maximum quantities to be on hand at any time.
W. D. Technical Bulletin TB MED 10 14 Feb. 1944	To assure highest care of orthopedic and amputation cases, treatment by medical officers and physical therapists must be more closely coordinated. Coordination to be effected by attendance of physical therapists at ward rounds and clinical orthopedic conferences. Sets forth instructions re muscle development and rehabilitation during convalescence.
W. D. Technical Bulletin TB MED 9 12 Feb. 1944	Penicillin.—Rescinds S.G.O. Circ. Letter No. 125, 16 July 1943. Provides instructions re use of penicillin in the selection of cases for treatment, storage, dosage, routes of administration and preparation for use, untoward reactions, surgical cases, and use of penicillin in certain specific injections. Is now standard item in Med. Dept. Supply Catalog (Penicillin Sodium, Item 16063).
A.S.F., Headquarters Circ. 47 12 Feb. 1944 Part 3, Sec. II	Medical Officers.—Sets forth training to be given newly commissioned Med. Corps officers who have recently completed 9 months' internship and are now being attached to general hospitals. Requires "on-the-job" training as understudies on active surgical and medical wards and clinics. Specifies subjects to be specifically emphasized on ward rounds. C. O. of each general hospital will appoint training officer who will be responsible for such training.
AR 40-505 C 6—4 Feb. 1944	Surgical and orthopedic appliances.—Changes AR 40-505, 1 Sept. 42. Includes minor shoe adjustments, arch supports, artificial eyes, hearing aids, braces, artificial limbs, and other orthopedic and surgical devices. Procurement of above items to be governed by AR 40-1705 and instructions in circular letters of S. G. and other W. D. publications. Also makes provisions re payment of accounts for civilian medical attendance.
W. D. Circular 73 17 Jan. 1944	Legal Assistance for Military Personnel.—Rescinds several W. D. Circulars. General supervision of plan for legal assistance to military personnel assigned to J.A.G. Sets forth general functions of legal assistance officers and location of civilian aid organizations.
W. D. Technical Bulletin TB MED 5 15 Jan. 1944	Portable Surgical Hospitals.

Hospital Ship.—The United States Army transport *Chateau Thierry* was designated on 29 November 1943 as a United States Army hospital ship in accordance with international practice, as set forth in the provisions of the Hague Convention X of 1907. The Army hospital ship *Chateau Thierry* will in the future be operated in accordance with the provisions of applicable treaties. (General Orders No. 5, War Department, dated 8 January 1944)

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Correspondence

LETTERS FROM CONSULTANTS IN MEDICINE

The three items following are extracts from recent letters from consultants in medicine in various theaters addressed to the Consultant in Medicine in the Office of The Surgeon General.

I was delighted to receive your letter of 1 December and your note about the captain who should be on his way home by this time. In July, August, and September, sandfly fever was a problem. Because no diagnostic test was available for its detection, medical officers hesitated to make the diagnosis on clinical grounds alone, with the result that "fever of unknown origin" was frequently diagnosed in the face of clinical signs and symptoms of the disease. In a hospital which I visited in August, of all diseased patients admitted the week before, only 4 percent have been diagnosed as sandfly fever. I gave a talk with the result that, in the following week, probably too many cases were diagnosed as sandfly fever. We are seeing wound diphtheria for the first time, and I am glad to say that it is being recognized and treated promptly.

Our program of "professional rehabilitation" is working nicely. It was planned that we would rotate battalion and regimental officers from combat units to service in hospitals after they had at least a year in field service, were 30 years or more of age, and had been through at least two combat periods. Our plan has interested definitely the commanders and they are asking that we rotate their medical officers. I am working now on a plan to use eventually our affiliated units for postgraduate training. I would appreciate it no end if you could let me know of any plans for a similar program at home, as it would help me in formulating policies for this theater.

The psychiatric problem in forward areas has been very well handled in this theater. This has been a rambling letter, but I wanted to let you know about things.

Your letter arrived on 21 February. The delay was due to the A.P.O. number being wrong. Everyone here is anxious for information on all problems encountered in this theater. Information of this kind might also be sent direct to individuals concerned. Most of the problems mentioned in your letter have received attention and the work accomplished thus far can be learned from the reports. If your letter had reached me promptly it would have helped tremendously, although any real change probably would have awaited new personnel. It should be possible to arrange for a division of problems in the most efficient manner.

The Bulletin of the United States Army Medical Department is splendid. We are looking forward to each hospital's receiving its medical journals direct, but they have not started to appear yet. All articles about scrub typhus, dysentery, dengue, early filariasis, fungus infection, and other diseases are read with interest. My time has been spent largely up North with general hospitals, and four scattered weeks at headquarters. My main consideration thus far has been to put over the consultant sys-

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tem and to enlarge it by two senior and two junior consultants. These are chiefs of services from general hospitals on temporary duty for a few months, to be replaced by others after a suitable period. Their reception has been enthusiastic. We are producing great clinical improvement and I may have to be content to concentrate on that alone. There is also a dermatologic, an orthopedic, and a neuropsychiatric consultant. I have visited the front. I may add that fungus infection of the external auditory canal is a frequent condition in this theater. We will be glad to have the drug you mentioned and to evaluate its efficacy as soon as possible.

Please write soon again. Could you call up the Army Medical Museum and ask how our pathology study is progressing? Your trip here is still a subject of conversation.

I was pleased to receive your letter of 26 November, which chased me around a bit, delaying a reply. It revived in my mind the invaluable talk you gave at the general hospital. I am taking the liberty of sending you a circular letter* from this headquarters and a copy of a letter just written to Hal, as they will show what has been occupying our minds. An official report will be made on the diphtheria situation, and we are hoping for advice on some of the controversial points.

The pace in this theater steps up rapidly but we are well ahead of the times on medical service; how long this will continue I don't know. We still lack professional staging in our new units, which we will continue to survey and make necessary adjustments. In the recently arrived unaffiliated general hospitals, in the main, there is professional strength, but it is spotty. In the medical service proper there are several officers of company grade of excellent background and promise.

During the last month we had a most instructive conference on V.D. control. In the third conference of chiefs of medical services in this theater held recently, administrative details absorbed much of the time, but attention was given to clinical and preventive medicine. We are particularly alive to the problem of typhus, and a commission for this theater is now studying the problem.

With kind personal regards.

IN A PORTABLE HOSPITAL

The following item, somewhat condensed, was written by Arthur Veysey of the Chicago Tribune Press Service and published in that newspaper, 14 March.

Los Negros Island.

In this hospital, a tarpaulin-covered shell hole, more than a hundred American soldiers have been saved from death. For four days during which the American foothold was not much bigger than a city block and when all of the men in the landing party were in the front lines, a gallant staff of four doctors and thirty medical corpsmen worked day and night to cut down the Jap battle-field toll.

Wounded men lay on the beach while the staff, carrying their entire supplies on their backs, waded ashore soon after the landing. The hos-

*The circular letter referred to appears in abstract form on page 21 of this issue of The Bulletin.

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pital commander pointed to a shell hole and said, "There's our hospital, boys." So the corpsmen dragged fallen trunks of cocoanut trees across the hole and spread a tarpaulin over them to keep off the rain. Two stretchers laid across a pile of packs provided an operating table. Two sergeants wiped mud off their hands, lighted small kerosene stoves, poured water out of canteens into pans, and when the water was boiling dropped in the surgical instruments.

Corpsmen already were bringing in the patients. As bullets were flying, they put them into nearby foxholes while awaiting their turn for an operation. Night closed in. But the boys lighted kerosene lanterns and pinned down the tarpaulin to make the place lightproof. Within four hours all the wounded had been treated. It was barely time, for the Japs were beginning to infiltrate into the beachhead and at dawn the hospital had a new line of patients. Plaster casts were molded around arms and legs. During the day Flying Fortresses dropped supplies. Parachutes were torn into sheets. When plasma ran short, the corpsmen lay down beside the patients and gave them their own blood. All corpsmen gave at least two transfusions each, stopping their work only long enough for their blood to be taken from them.

During the second evening the doctors heard a noise outside. A corpsman took a gun, and when the hospital lights were out he crawled under the tarpaulin. His gun spoke. He crawled back. "A Jap only 10 feet away," he said, "was ready to toss a grenade in here." In a foxhole serving as a ward nearby another Jap killed a corpsman. A Jap jumped into another foxhole with six Americans, including a chaplain who was assisting as ward attendant. The Jap was killed and the chaplain wounded. On the third day reinforcements arrived. On the fifth day a larger hospital unit landed and took over some of the work.

"On those first days we were so short of men that every loss made death just so much closer for the rest," the hospital commander said. "All the injured realized that and begged us to let them go back to their buddies. Those who could walk we sent back. Whatever we could do for those boys was a privilege."

Filariasis.—Philip H. Hartz, Public Health Service, Curacao, N. W. I., published a paper on the "Histopathology of Filariasis" in the *American Journal of Clinical Pathology*, January 1944, p. 34. In 5 of 10 cases of filariasis, epithelioid cell endo- and perilymphangitis was found, sometimes combined with analogous changes in the lymph nodes. These processes seemed to be caused by the presence of living "macrofilariae," though they can still be present some time after the death of the worms. He says the changes must be considered as typical but not as specific of filariasis, and they form a strong indication for search of the worm; they should not be mistaken for tuberculosis.

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Special Articles

Early Filariasis in American Soldiers

Lieut. Colonel William B. Wartman, M. C., and Major Boyd G. King, M. C., of a U. S. Army general hospital, have reported (in two separate papers not yet published) their observations on 268 American troops with filariasis. These patients had lived an average of four months on certain islands of the Pacific and, since most of them had never been in the tropics before, the lesions found were believed to represent the early manifestations of filariasis. These observations in most cases began within a few days or weeks after the first symptoms. The men lived in or near the jungle in proximity to natives, many of whom are known to have filariasis. About one-fifth of the troops on one island were admitted to hospital with manifestations attributed to filariasis. The earliest onset was three months after arrival; however, no average incubation period for the group can be positively stated, although it is fairly certain that no symptoms occurred before three months' exposure.

SYMPTOMS

The first symptoms were pain and swelling or redness of an arm (38 percent), leg (14 percent), or scrotal region (56 percent). In five cases the arm and genital symptoms occurred simultaneously. The syndromes observed fall into three categories: (1) lymphangitis of extremity or trunk; (2) acute inflammation of the scrotum or its contents; and (3) lymph node involvement. Mild fever was present in 19.7 percent of the cases and was prolonged occasionally up to six weeks. In one case the fever reached 104° F. at onset and fell by lysis over a period of twelve days with no local symptoms until the sixth day, when transient epididymitis occurred.

Many of the cases had occurrences of either subcutaneous or genital involvement one or more times; in one patient lymphangitis occurred six times. The acute local symptoms were of short duration, usually less than ten days. A striking feature of the entire group was the lack of severe constitutional symptoms. They did not feel sick and in no case did

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there seem to be danger to life; however, the lesions were incompatible with full field duty. The average hospital stay was 15.9 days, after allowing for concurrent illness.

The most common lesion observed was inflammation of the epididymis, testicle, scrotum, or spermatic cord, which occurred in 71.6 percent of the patients. Occasionally, all intrascrotal structures were swollen and indurated, making it impossible to differentiate them. The testicle itself was swollen in only 25 cases. The pain and tenderness of the genital lesions were at times exquisite and were more marked than in the lymphangitis of the extremities.

Lymphangitis occurred in about half of the cases. It was associated with a red streak and a firm underlying cord, or diffuse redness and swelling with local heat and moderate tenderness, and was observed to spread centrifugally.

Lymphadenopathy appeared earliest in the epitrochlear region. The frequency with which adenopathy was bilateral in the inguinal and femoral regions, as contrasted with the infrequency of the lymphangitis in the legs, suggests a general lymphatic hyperplasia as being a part of the pathology of filarial infection. The enlargement of the nodes tended to persist; in a few cases observed for the second time in the hospital, the adenopathy was either unchanged or was more extensive. The nodes were always quite firm and usually single but some were in clusters.

Moderate leukocytosis was present in about one-third of the patients. The eosinophils were increased in about two-thirds and they were invariably mature cells. The highest percentage of eosinophils was 69 and the average for the entire group was 8.5; the average for 65 patients in the group who also had intestinal parasites was 10.3 percent, and the average for 201 patients without intestinal parasites was 8 percent. (A normal eosinophil count was considered as from 0 to 4 percent of 5,000 to 10,000 white blood cells.) The stools were examined by the zinc sulfate flotation method in 264 cases, and 25 percent of them showed some variety of intestinal parasite, hookworm and whipworm predominating.

NO MICROFILARIAE FOUND

All patients were examined either by staining a thick blood smear or by a search of the formalinized sediment of 1 cc. of blood by Knott's method. After diligent search at various times of the day no microfilariae were found. Seven typi-

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cal cases were selected for repeated blood examinations (in the two in whom biopsies had shown adult female filariae in lymphatic tissue, the blood was examined at four different hours of the day and night on four different days), and they were consistently negative for microfilariae. In addition to the 268 patients of this group, the blood of 144 other men was examined. Some of the latter were from the most heavily infected battalion, while others were from a unit which had spent from six to eleven months on one island and some of them five months on another island. All of these specimens were likewise negative for filariae. Futhermore, x-ray films made in nine cases with definite lymphangitis or adenopathy and in five cases of epididymitis and funiculitis failed to show calcium deposits.

DIAGNOSIS

Filarial infection can be diagnosed by three methods: (1) finding adult or larval filariae in tissue; (2) finding microfilariae in the blood; (3) finding calcified worms by x-ray technique. The diagnosis can be established with little doubt clinically. The history of prolonged stay in an endemic area in close association with natives, the finding of lymphangitis of an extremity, trunk, or genitalia coming on after an interval of at least three months, combined with adenopathy, eosinophilia, and a positive intradermal reaction complete the characteristic picture of early filariasis. From a clinical point of view, the character of the lymphangitis, especially its tendency to advance peripherally and its repeated occurrence, is emphasized.

INTRADERMAL REACTIONS

The intradermal reaction as described by Taliaferro and Hoffman and by Fairley was used as an aid in diagnosis, the antigen being prepared from *Dirofilaria immitis* as described by Fairley. The test was made by injecting 0.1 cc. of the antigen intradermally on the volar surface of the forearm. No reaction was considered positive unless it was 2 plus or greater, considering either the immediate or delayed reaction. Control tests were done on individuals who had never spent time in the tropics. Using antigen "B" which differed from antigen "A" only slightly in the technique of preparation (the only difference in the two antigens was the strength of the solution during extraction, "A" being 0.1 percent and "B" being 1 percent while incubating with the dirofilaria powder), the results of

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the test on 164 patients were positive in 90.8 percent. Among the controls using "B" antigen, only 10.5 percent gave positive reactions.

TREATMENT

Treatment with drugs aimed at eradicating filarial infection is ineffective. The treatment used in this group of patients was mostly sympathetic, consisting of rest until the acute symptoms subsided. All but five of the 268 patients were evacuated to the United States, because it was thought that repeated reinfection might produce the more serious later pathology of filariasis and because residence in a temperate climate seems to reduce the attacks of lymphangitis which may occur soon after return to the tropics. Sulfathiazole in full therapeutic doses was used in three severe cases with fever without any apparent effect. Four patients developed acute lymphangitis while taking sulfathiazole or sulfadiazine for the treatment of gonorrhea. Mapharsen was given to 21 patients, three doses a week, one week apart, the first dose being 0.04 gm. and the remaining being 0.06 gm. by vein, and in 17 it had no immediate effect; in two patients, acute lymphangitis occurred in a few hours after administration, and in one patient an exacerbation of epididymitis occurred twenty-four hours after the injection.

The prophylactic treatment obviously is mosquito control. Personal protection against mosquitoes must be practiced day and night, because of the daytime biting habits of the *Aedes variegatus*, the chief vector in the Pacific islands east of the New Hebrides group.

The outlook for immediate recovery of the early lesions is excellent. The final outcome in these patients can only be determined after prolonged observation.

PATHOLOGY

Biopsies were made on 17 patients with clinical evidences of filariasis, using 20 lymph nodes and 4 cordlike structures from areas of acute lymphangitis. The biopsy material was removed at different times during the day and immediately placed in 10 percent neutro-formol saline or in Zenker-formol solutions and fixed for fifteen to twenty-four hours, embedded in paraffin, sectioned at 5 microns, and stained with Harris' hematoxylin and aqueous eosin. At intervals various other stains were used.

Adult male and female filarial worms were found in five of the biopsies. Both living and dead worms were present

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and the females contained in their uteri large numbers of eggs and microfilariae which appeared morphologically mature. No microfilaria was found in the tissues.

Bacteriologic studies of the biopsies as well as tissue sections especially stained for bacteria were negative, indicating that the lesions were due to the worm and not to bacteria.

The tissue reactions in the nodes consisted of granulomatous inflammation with marked hyperplasia of the macrophage (reticulo-endothelial) system and tissue eosinophilia. The lymphatic vessels showed reticulo-endothelial hyperplasia, lymph thrombi, and varying degrees of inflammation with or without thrombosis.

Wartman suggests that the absence of microfilariae from the blood may be due to the avascular nature of the granulomata, the hyperplasia of macrophages, and the small number of worms found in the biopsies. The histories of these patients prove, he says, that white persons can be infected during short visits to endemic areas and that signs and symptoms of filariasis may develop as early as three months after exposure to infected mosquitoes.

Survey of Filariasis in Puerto Rico

Puerto Rico has long been recognized as an endemic focus of filariasis (*Wuchereria bancrofti*). While previous workers have studied the incidence of filariasis in insular troops, information is not available as to whether troops from continental United States stationed in this area run the risk of contracting this disease. From the clinical standpoint, there is no evidence that continental troops stationed in Puerto Rico develop filariasis. Recently, naval medical officers in the Samoan Islands reported filariasis occurring in two persons from continental United States who had been exposed for periods as short as five and nine and one-half months.

At the suggestion of the surgeon, Caribbean Defense Command, the department surgeon ordered a survey among continental troops to ascertain what percentage, if any, had demon-

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The survey was conducted by Major G. J. Dammin, M.C., Captain T. H. Weller, M.C., and Captain F. B. Frost, Sn.C., all of the Antilles Medical Department Laboratory, who together with Colonel Clyde C. Johnston, department surgeon, made the report to The Surgeon General. Miss Katherine A. Patterson and Sergeant Edgar L. Harwood gave technical assistance.

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strable circulating microfilariae in the blood stream. The negative results obtained are of interest in that, in the areas in which these troops resided, numerous natives of the island suffer from elephantiasis to a marked degree. As previous workers had shown that Aguadilla and San Juan were highly endemic foci, an attempt was made to examine continentals who had been stationed in and around those cities.

METHODS

Between 3 and 27 January 1944, a group of continentals who had been stationed in the Puerto Rican Sector for a minimum of eighteen months was examined. The group consisted principally of enlisted men belonging to Army Air Forces and Military Police organizations, of whom about 60 percent were stationed near Aguadilla and the remainder in San Juan. The length of service in the Puerto Rican Sector of this group averaged 24.4 months. The average age of the group studied was 25.9 years.

The material collected from each person consisted of capillary blood from which two thick-film preparations were made. In every instance the blood films were collected at night, sometime after 2230 o'clock. The next morning the slides were stained with Bullard's hematoxylin, according to the method used by O'Connor and Hulse[1] as follows: After drying, the film was dehemoglobinized in tap water, fixed in equal parts of ether and alcohol, dried again, and then stained. Control blood films containing microfilariae were stained by the same technique. Using a magnification of 100, the stained thick films were studied systematically so that the total area of each thick film would be examined.

None of the thick-film preparations from the group of continental soldiers was found to contain microfilariae.

DISCUSSION

The negative findings in the present study represent the first data available on the incidence of filariasis, as demonstrated by presence or absence of circulating microfilariae, in a group of continentals who have been stationed for at least eighteen months in the Puerto Rican area. However, because of the relatively incomplete knowledge of this disease, the significance of these results is not clear.

1. O'Connor, F. W., and Hulse, C. R.: Studies in Filariasis. I. In Puerto Rico, Puerto Rico J. Pub. Health, 11:167-272, 1935.

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The most complete survey of the incidence of filariasis in Puerto Rico is that of Hoffman et al.,[2] who found that 5.5 percent of 4,950 persons studied had demonstrable circulating microfilariae—of a group in Aguadilla, 8.7 percent were positive, while in the San Juan area 7.8 percent showed microfilariae. Inasmuch as the chief vector (*Culex fatigans*) of filariasis in Puerto Rico is extremely common and has been shown to feed in the early evening, it might be expected that some of the continentals studied would have been exposed to the bites of infected mosquitoes during residence in those areas. However, as O'Connor pointed out that filariasis is a familial disease, perhaps this indicates that repeated infections are necessary before microfilariae are present in numbers sufficient to break through a hypothetical lymphatic barrier and to appear in the peripheral blood stream in numbers great enough to be demonstrated in thick film preparations; or it may indicate that the insect vector has a very limited flight range following a blood meal. Another unknown factor that invalidates any conclusions that may be drawn from this study is the lack of definite information on the incubation period of filariasis. Strong[3] states that it is not known how long it takes for the larvae to become mature, but it is probably many months before the female begins to give birth to microfilariae. In this connection, it should be noted that Dickson et al.[4] reported finding the adult worm but no microfilariae in patients who had been exposed for only five and nine and one-half months.

O'Connor and Hulse have stressed the marked nocturnal periodicity of the microfilariae in Puerto Rico. Therefore, it is felt that if any of the persons had any appreciable number of circulating microfilariae, the technique used in the present survey would have demonstrated their presence.

SUMMARY

A group of continental soldiers who had been stationed for a minimum of eighteen months in the Puerto Rican Sector were examined for circulating microfilariae by the thick-film technique. Nocturnal blood specimens were used. All of the specimens were negative for microfilariae.

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2. Hoffman, W. A., Marin, R. A., and Burke, A. M. B.: Filariasis in Puerto Rico, Puerto Rico J. Pub. Health, 7:321-358, 1932.

3. Strong, R. P.: Stitt's Diagnosis, Prevention, and Treatment of Tropical Diseases, 6th ed. Philadelphia: The Blakiston Company, 1942.

4. Dickson, J. G., Huntington, R. W., and Eichold, S.: Filariasis in Defense Force, Samoan Group, U. S. Nav. M. Bull., 41:1240-1251, September 1943.

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Scrub Typhus

Scrub typhus fever is one of the group of typhus-like fevers and is distinguished from other members of the group by its mode of transmission, the occurrence of a pathognomonic lesion, the eschar, and the presence in the blood of agglutinins for the *Proteus* OXK bacillus. The disease is probably identical with tsutsugamushi disease (Japanese river fever), pseudotyphus of Sumatra, Sumatra mite fever, tropical typhus of the Federated Malay States, and Coastal (and Mossman) fever of North Queensland. These diseases have a wide geographical distribution in the Asiatic-Pacific area extending from Japan down along Indo-China through the Federated Malay States into the Bismarck Archipelago.

Scrub typhus, regarded formerly in the United States as a curiosity, has assumed military importance because of its prevalence in areas in which our forces are now engaged, namely, the Southwest Pacific Area, and the China-Burma-India Theater.

The Surgeon General authorized in September 1943 the sending of an investigative team to New Guinea to study scrub typhus. This group immediately went into the field under the auspices of the United States of America Typhus Commission and the Army Epidemiological Board and under the direction of Dr. Francis G. Blake assisted by Dr. Kenneth F. Maxcy. In addition, three Army officers were assigned to the group: Lieut. Colonel Joseph F. Sadusk, Jr., M.C., Captain Glen Kohls, Sn.C., and First Lieutenant E. John Bell, Sn.C. With the exception of the entomologist, Captain Kohls, who remained for further study, this group returned to the United States in late December 1943 with information concerning the clinical and pathological aspects of scrub typhus and the conditions under which the disease is transmitted to man by mites. In addition to serological specimens from patients, animals inoculated with the causative organism were brought back. The strains are being studied at the Army Medical School, the Naval Medical Research Institute, and the National Institute of Health with the ultimate purpose of the preparation of a protective vaccine, if possible.

Prepared in the Office of the United States of America Typhus Commission in the Office of The Surgeon General.

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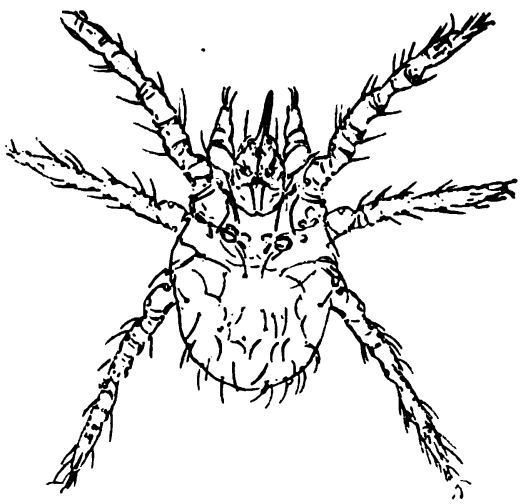
Having completed the first part of the mission, a preliminary report was rendered by the director of the group. The information reported here is based on his report.

ETIOLOGY

Confirming the findings of previous investigators, the causative organism is a rickettsia, which may be recovered from the patient's blood during the early stages of the disease. Isolation of this organism is extraordinarily simple. A small portion of blood clot, obtained aseptically, is ground up in a mortar with sterile sand and normal saline solution; after spinning down the sand in a centrifuge at low speed, 0.3 cc. of the supernatant fluid is injected intraperitoneally into mice. The mice die in from ten to sixteen days; smears made from serous membranes of the peritoneal cavity and stained with Giemsa's stain reveal the presence of intra- and extracellular small diplococcal bodies — the rickettsia of scrub typhus.



Neoschongastia minor. An example of the mite which causes scrub itch in New Guinea. Photograph Army Medical Museum 04438. (45X)

Evidence indicates that scrub typhus is transmitted to man by the bite of the larval form of mite which passes through four stages — egg, larva, nymph, and adult. The last two stages feed on plants and thus are not parasitic to man. Work by the Japanese with the mite *Trombicula akamushi* —the vector of tsutsugamushi disease—demonstrated that the disease is hereditary in the mite and thus passes from one generation to another. The larval form normally feeds on the rat or bandicoot in New Guinea; man is only an accidental host.

While present knowledge does not permit the association of a specific species of mite with transmission, it appears likely that the disease is not transmitted by the itch mite since little correlation, if any, was found between the incidence of "scrub itch" and the frequency of infection with scrub typhus. In some areas, there was considerable complaint of "scrub itch" but no scrub typhus, while in other areas there was no complaint of "scrub itch" but there were cases of scrub typhus.

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Even less information is available concerning the animal reservoir of this disease. Rats and bandicoots abounded in the area studied by the group; these animals almost invariably harbored mites, particularly in and about the ears of the rats, and in the marsupial pouch of the bandicoot. Mites were also found on lizards and birds.

Field investigations are being continued in New Guinea by the entomologist of the group to determine (1) the specific vector of scrub typhus and (2) the animal reservoir of the disease.

EPIDEMIOLOGY

Transmission of scrub typhus was not found to be seasonally limited. During the last year, new infections were reported in every month and peaks of incidence were associated with the arrival of new units, rather than with the season of the year.

The risk of infection was not evenly distributed geographically but seemed to be associated principally with kunai grass fields bordered by the jungle along water courses. Data obtained from units suggested that the danger of infection was maximal at the actual border of the kunai grass and jungle, caused perhaps by the fact that moist-ground conditions prevail in this area. Such conditions are favorable to the growth and activity of mites.

The disease is therefore focally distributed, but present knowledge does not permit a distinction between those localities in which the danger of infection is great and those in which there is little or no risk.

The minimum incubation period is about ten days; the maximum period is unknown, but it does not appear from the studies of the investigative group that the onset can be delayed longer than eighteen days after exposure. In the New Guinea investigation, 71 percent of the cases became infected within the first days after arrival and more than 90 percent of the cases occurred within six weeks; thereafter, the incidence became sporadic. As a camp area is cleared and put in order, the risk of infection becomes progressively less. After two months, in all instances observed, the danger had been reduced to a low level, only sporadic cases occurring subsequently.

To summarize, the risk of infection is maximal during the first four to six weeks after an organization has occupied a camp site which has not been previously used, or when an organization engaged in combat is constantly moving into and occupying new areas.

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PATHOLOGICAL ANATOMY

Scrub typhus, like other forms of typhus, is basically a disseminated, focal vasculitis and perivasculitis of the smaller blood vessels. The vessels principally involved are those of the skin, lungs, heart, and brain.

Although endovasculitis, thrombosis, and hemorrhage may occur, they are conspicuously less marked than in European (epidemic) typhus. The vascular lesions consist of perivascular accumulations of monocytes, plasma cells, and lymphocytes with moderate focal edema. At the site of vascular lesions, small hemorrhages may be seen, but they are not frequent, except in the lungs. In severe lesions, necrosis of adjacent tissue cells may occur, especially in the myocardium and brain nodules. The vasculitis and perivasculitis in the lungs cause a true typhus pneumonia with thickening of the alveolar walls and essentially a large mononuclear exudate; serum and red blood cells are also often present in the alveolar spaces.

In severe vasculitis of the myocardial vessels there may be infiltration of the interstitial tissue with mononuclear cells, edema, and even small areas of focal necrosis of muscle fibers. The brain is frequently the seat of a focal perivascular reaction characterized by proliferation of glial cells and infiltration with large mononuclear cells.

CLINICAL FEATURES

Following an incubation period of from ten to eighteen days, the onset is sudden with headache, chilliness, and fever. During the first week, the fever increases stepwise, reaching from 102° to 105° F. by the beginning of the second week and ordinarily remaining elevated until the beginning of the third week, at which time it subsides by lysis. There may be wide swings in the temperature curve, particularly if aspirin is administered. Profuse sweats accompany these violent swings in temperature. The headache increases with the course of the disease and becomes quite severe, failing to respond at times to any type of medication. Along with this, the patient becomes apathetic; in severe cases there is a muttering, restless delirium. Anorexia is common.

A characteristic eruption, ordinarily consisting of dull red macules which at times assume a maculopapular form, appears on the trunk during the fifth to eighth day. This rash ordinarily fades within several days but at times may be of an

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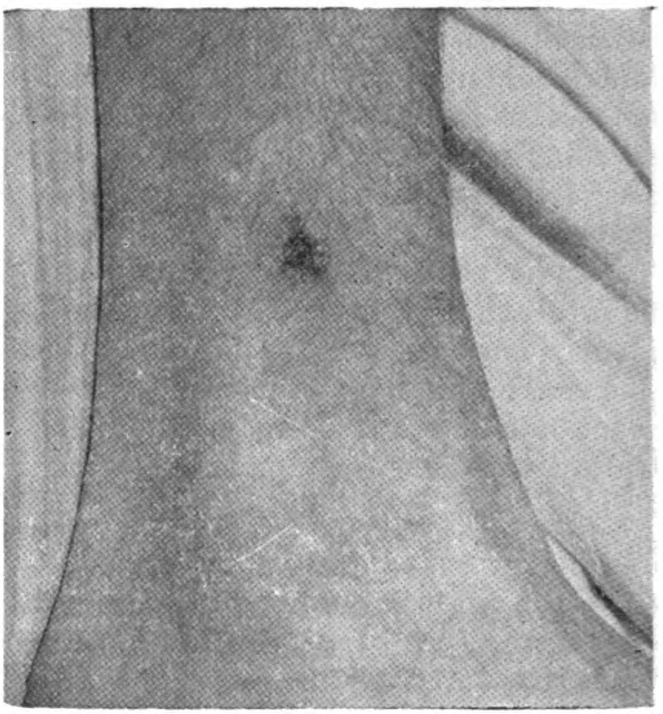
evanescent character, appearing and disappearing almost within the same day. An almost constant feature is a generalized enlargement of the lymph nodes which appears early and persists ordinarily for the duration of the active stage.

The most pathognomonic sign of scrub typhus is the "eschar" which is a round or oval ulcer, surrounded by a slightly elevated pink areola and covered with a black scab. This primary lesion is located indiscriminately all over the body with the possible exception of the scalp, palms, and soles. In moist areas such as the axilla, scrotum, and perineum, and occasionally elsewhere, the black central scab is lacking, the lesion appearing as a punched-out shallow ulcer with flat greyish or greenish-yellow base surrounded by the usual slightly elevated pink areola.



Eschar of scrub typhus, duration 2d day. Onset 18 January 1944 with weakness and high fever, severe headache, backache, and aching in testes. New Guinea, 20 January 1944. Museum and Medical Arts Service photograph.

A slightly enlarged tender spleen is common. A pneumonitis with characteristic physical signs of fine medium moist rales usually over the lower lobes is frequently present. The pneumonitis may extend into the upper lobes with scattered sibilant rales, diminished breath sounds at the bases, and tachypnea with a tendency toward hyperpnea and cyanosis in the severe cases.

Neurological symptoms, in addition to the usual headache and apathy, consist of delirium, twitching, and variable degrees of deafness, usually transient in nature.

While variable degrees of myocarditis are undoubtedly present in many cases, definite clinical evidence is not frequently present. The usual tachycardia, hypotension, and

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signs of pulmonary congestion encountered in severe cases during the second and third week of the disease may be due in part to the damage to the left ventricle, but could be due to peripheral vasodilatation and the pneumonitis.

Early in the disease, the leukocyte count is either normal or decreased, but as the disease progresses, particularly in severe cases, the leukocyte count increases, first with an increase in cells of the granulocytic series followed by an increase in lymphocytes.

LABORATORY DIAGNOSIS

Confirmation of the diagnosis of scrub typhus by laboratory means may be obtained by a diagnostic *Proteus* OXK agglutinin test, titer of 1:160 or higher, with a properly standardized and controlled antigen. A negative test, however, does not exclude scrub typhus if all other characteristic features are present. The causative rickettsia has been recovered from the blood of patients whose serum failed to exhibit a diagnostic titer with *Proteus* OXK antigen. When positive, such a titer ordinarily manifests itself by the end of the second or the beginning of the third week of disease.

There is no specific treatment of established value. Sulfonamides have no effect and, unless secondary purulent complications such as bacterial pneumonia develop, should not be employed. Penicillin employed in maximum dosage had no effect on the course of the disease.

The most important aspect of treatment is good nursing care. Symptomatic treatment should not be overdone. When patients with pulmonary complications become cyanotic, oxygen is indicated and should be used.

Studies of the pathological physiology in this disease demonstrate that a hypochloremia frequently develops; to counteract this, the patient should receive from 6 to 8 grams of salt daily either by mouth or parenterally in the form of normal saline.

The use of plasma should be limited to cases having a proved hypoproteinemia sufficiently severe to threaten the development of generalized edema.

A long period of convalescence is required, particularly in severe cases; not infrequently convalescence may extend into the third or fourth month.

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PREVENTION

Based on present knowledge, the following measures are effective in controlling the incidence of scrub typhus:

1. Locations which are to be used as new camp sites should be prepared as fully as possible before the arrival of a new unit, employing native labor so far as possible. All kunai grass should be cut level with the ground and, after drying for several days, collected and burned or hauled away. It is highly desirable to burn over the area with a power oil sprayer.

2. Sleeping on the ground should be avoided, cots being provided whenever possible. Floors for tents, preferably raised two or three feet above the ground, are desirable.

3. Individual control methods apply particularly to personnel in combat areas or to those working in known endemic foci. At the earliest possible time after exposure, men should be instructed to take a bath with thorough soaping and scrubing of the skin with a rough cloth. Anti-mite repellents should be employed according to instructions given troops.

FIGURE 1. Kunai grass in New Guinea.

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FIGURE 2. With the tall kunai grass cut, natives begin the task of close cutting and raking to facilitate burning. This is being done throughout the area of a hospital in the program against typhus.

FIGURE 3. After cutting and piling the kunai grass, oil is sprayed on and fired with the use of a Hudson power spray.

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FIGURE 4. Natives rake and load kunai grass on trucks to be hauled to an area set aside for burning the grass.

FIGURE 5. A cleaned area at a station hospital with kunai grass cut and the area burned and sand and gravel spread.

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FIGURE 6. In the program to keep typhus-bearing animals from hospital wards, the floors and sides are cemented.

War Wounds of the Extremities

Wounds of the extremities constitute from 65 to 70 percent of all wounds seen in Army hospitals in combat areas. The incidence of wounds of the extremities in the Civil War was 70.8 percent; in World War I, 76.4 percent; and thus far in World War II, 73 percent. Although the incidences of wounds of the extremities in these wars are nearly identical, in this war such injuries especially to the lower extremities are usually more severe. This is due in part to the more violent explosives used in this conflict, but it is particularly due to the widely used land mine, which causes extensive damage when exploded by the tread of the soldier's foot. The extremity is literally pulpified by the terrific explosion and can often be treated only by amputation. It is not uncommon to see patients with both lower extremities seriously damaged.

Prepared by the Surgery Division, Office of The Surgeon General.

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SOFT TISSUES

While the fundamental principles of treatment of war wounds are identical with those of all wounds, certain war conditions preclude the use of some surgical measures and make modification of others necessary. All surgeons who have had experience in this war subscribe to the basic principle of thorough débridement of wounds. The proper performance of this procedure is the most important step in the treatment of war wounds, certain reports to the contrary notwithstanding. The heavier the contamination of the soil of the battle field, the more important adequate débridement becomes. On the other hand, wounds occurring in a relatively clean environment such as on shipboard or in airplanes, may require less extensive débridement. In civil life the surgeon can spend as much time as is required to do the most thorough and meticulous wound revision; when the press of work is not great, the military surgeon can do likewise; however, when casualties are heavy and the litter cases pile up outside the operating room the dictum of the "greatest good for the greatest number" demands a more expedient but perhaps less ideal débridement. Having accomplished this important fundamental in the surgical care of a wound in the most approved manner, the civilian surgeon frequently closes the wound by primary suture, because he has operated within a short time following injury, has had access to a well-appointed operating room with adequate assistance, and can keep his patient in one hospital for close supervision by him and his staff as long as is necessary. Under such circumstances primary closure is proper. Consider the situation confronting the military surgeon who sees his patients several hours after wounding even under the best conditions and, frequently, not until many hours have elapsed; all wounds are contaminated; the operating room, though well equipped with instruments, may be in a tent or an improvised shelter; and the patient usually will not remain long under supervision and in the forward hospital, since to maintain mobility of such forward installations he must be evacuated promptly to a hospital farther back. The dangers of primary closure under these circumstances are obvious, and the principle of leaving *all* war wounds open after débridement is sound. Although a certain percent of war wounds can be closed successfully by primary suture, the large number of disastrous complications which will and do ensue after routine closure of these wounds makes it imperative to follow the

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rule—no primary closure of war wounds; and yet this principle of war surgery is too often not applied by surgeons recently arrived in battle areas, and they have to observe the disastrous results following primary closure to be convinced of their mistakes in judgment.

Certain facts concerning débridement have been learned from experiences in this war. Tissue damage is frequently more extensive than is apparent on the surface. Although the wound looks innocent from the outside, there may be considerable shattering and destruction of tissues in its depths. For this reason all wounds must be thoroughly explored through adequate incisions in skin and fascial planes in order that access may be had to all parts of the wound. This does not mean overexcision of skin, which is a common fault in technique. When a wound is thus explored, it is common to find beneath the small wound of entrance, foreign bodies, bits of clothing, hematomas, devitalized muscle, and damage to a major vessel. Having excised all devitalized and soiled tissue, hemostasis is effected, and vaseline gauze dressings are laid loosely in the wound. Tight packing of a wound is comparable to primary closure and must be avoided for this reason and on account of its "tourniquet effect." It has been found wise to splint the part even in the absence of fractures.

BLOOD VESSELS

Peripheral vascular injuries, especially those involving major vessels, are particularly significant complications of wounds of the extremities and occur much more frequently than is commonly realized. This is shown by the fact that in one of the vascular centers in the zone of the interior, the number of operations now done for traumatic aneurysm average about twelve per month. Various forms of injuries may occur including laceration of the vessel, partial or complete severance, thrombosis, acute reflex vasospasm, false aneurysm, and the subsequent development of arteriovenous aneurysm. Vasospasm is a natural response to those forms of trauma which directly or indirectly affect vascular structures and is therefore a common occurrence in most of these injuries. Depending on a number of factors, it may involve only a small part of the vessel, may spread to neighboring vessels of the entire extremity, or may be generalized to involve even larger areas of the body. Although vasospasm may be considered a compensatory mechanism under certain conditions, if contin-

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ued it may lead to hazardous consequences. In cases in which the traumatism to the tissues has already seriously impaired their vitality, vasospasm may be the deciding factor on which the life of the limb depends. An additional consideration is that in some cases the resultant ischemia may contribute to the development of gas bacillus infection.

When there is direct injury to major vessels with laceration, partial or complete severance, or thrombosis, ligation will usually be necessary. The repair of these injured vessels in a way to maintain blood flow through them is rarely feasible because of the conditions under which they occur and must be handled and because of the character of the injury. Cleanly incised longitudinal wounds which may be most successfully sutured, or even incised transverse wounds which which may be repaired by end-to-end anastomosis or preferably by nonsuture tube techniques are only occasionally observed in war injuries. For these reasons the more practical and realistic procedure of ligation usually must be employed. This should be done not by ligation in continuity but by placing nonabsorbable ligatures well above and below the site of injury with excision of the intervening damaged segment in order to eliminate the dangers of secondary hemorrhage, thrombosis, and vasoconstrictor influences. Other cases with thrombosis should be similarly ligated following excision of the thrombosed segment. These cases must be distinguished from localized segmental spasm of the artery. In cases manifesting this phenomenon, the limb is cold, pale, and pulseless, but evidence of hemorrhage or hematoma indicating that the vessel has been lacerated may not be present. This type of reflex vasospasm has appeared in cases in which the site of the trauma was remote from the vessels. A case was observed in which a shell fragment produced a wound of entrance and exit on the lateral aspect of the right calf at its mid-point. Although at operation the wound track was found to be from 5 to 8 cm. from the posterior tibial artery, the artery appeared in complete spasm. In some cases in which the wound was immediately adjacent to the vessel, which revealed no grossly visible injury, the artery has been found in complete spasm. In other cases spasm has developed following minimal manipulation of a simple fracture. The degree of vasospasm varies from localized constriction with consequent minimal ischemia to a more extensive and generalized involvement, espe-

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cially of the collateral circulation, with sufficient ischemia to produce actual gangrene. Moreover, the vasospasm may persist for periods as long as or even longer than forty-eight to seventy-two hours.

Rational treatment in these cases is directed toward counteracting vasospasm and producing maximum vasodilatation in the involved extremity. Since the disturbance is apparently due to a vasomotor reflex initiated in the traumatized tissues and since vasoconstrictor impulses are transmitted by way of the sympathetic nerve fibers, interruption of these impulses in the circuit prevents vasospasm and permits vasodilatation. This may be done by débridement of surrounding traumatized tissue, periarterial sympathectomy or procaine hydrochloride block of the regional sympathetic ganglia. The latter procedure is probably the most effective method of producing maximum vasodilatation in these cases and should be employed in all types of peripheral vascular injuries accompanied by manifestations of vasospasm. It may be necessary to repeat the sympathetic block at least once or twice daily for several days. Close observation is essential in cases with injury of the major peripheral vessels and, for this reason, these patients should be evacuated as soon as possible after injury to installations with facilities for the proper surgical care described above. They should not be moved from these installations and should not have plaster of paris cast applied until the danger of ischemia is past. Two vascular centers have been established in general hospitals in the United States for the specialized treatment required in the management of serious problems and complications, such as traumatic aneurysms associated with peripheral vascular injury and disease. All cases of this nature are sent to these centers.

NERVE TRUNKS

Injury to major nerve trunks occurs in from 12 to 15 percent of all extremity wounds in this war. The protracted management, the crippling effects, and the not too satisfactory results of treatment of these injuries emphasize their importance. The possibility of this complication should always be considered and efforts directed toward early diagnosis in order to facilitate proper evacuation and early treatment. While under war conditions, primary anastomosis of severed peripheral nerves is not generally feasible, it should be attempted if the nerve ends are readily accessible and can be

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approximated without tension. This should be done as an end-to-end anastomosis with the ends to be united cut at exactly right angles with a sharp scalpel. During the suture, axial rotation should be avoided. Fine silk or tantalum wire sutures should be employed and the ends of the nerve coapted by simultaneously pulling taut all the sutures which have been passed through the epineurium only of both stumps. If primary anastomosis is not possible, the injured nerve ends should be identified and a sling suture of fine stainless steel wire placed between them or they should be anchored with similar suture material to the surrounding tissue to prevent retraction. Metal suture material is advocated here because it facilitates roentgenographic identification preceding subsequent repair. To minimize the irreparable degenerative changes that occur in the end plates of severed nerves, early repair of these nerves is essential. For this reason, every effort is made to evacuate these patients as soon as possible to the neurosurgical centers in general hospitals in the United States where operative repair and the necessary postoperative physiotherapy can be instituted. At present, eighteen neurosurgical centers are strategically located, equipped, and staffed to provide the best treatment available for these cases. Recent experience has shown that operative repair can be done within a week to ten days after the wound has healed, which is much earlier than formerly was thought possible. This is particularly desirable since the earlier the operation can be done, the better the end result is likely to be. The use of tantalum wire for suture material and tantalum foil for wrapping the anastomosed nerve end is considered especially valuable. This metal element produces minimal tissue reaction and protects against intraneural and invading scar tissue formation. Because of the protracted recovery period in these cases, careful postoperative care and follow-up observations are essential in their proper management and study. A program of this nature permitting prolonged observation has been instituted in these centers.

BONES AND JOINTS

Bone and joint involvement in wounds of the extremities are among the most important complications because of the protracted hospitalization and disabilities which they cause, especially if the early treatment has been inadequate. The difficulties in the ideal management of these cases are greatly

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increased under war conditions. Moreover, the highly destructive shattering fractures with great loss of bone substances commonly observed in such cases emphasize the problems encountered in their treatment. Efforts have been directed therefore toward prompt and proper management along principles which under war conditions have given the most satisfactory end results. The essential problem in the management of wounds of the extremities in the forward echelons is concerned principally with the most expedient and comfortable method of immobilization during evacuation. It must provide adequate fixation for ambulance or jeep transport over rough roads and, at the same time, assurance that circulation of the extremity will not be jeopardized or that additional soft part injury will not occur. These desiderata are best met for fractures of the femur about the knee and of both bones of the leg above the ankle by the use of the Army half-ring splints with the litter bar, ankle strap, and five triangular bandages. Traction is effected for a short period of time by the ankle strap or hitch about the ankle with the shoe on, but prolonged use of this method is dangerous as it produces skin necrosis. Skin traction with the shoe off is much safer. This is the most satisfactory method for evacuating these cases from the first and second echelons to the evacuation hospital or even to the general hospital. Skeletal fixation and skeletal traction in patients who are to be transported have resulted in much discomfort and in bone infection in the pin wounds. Rarely these procedures may be used in the management of these cases in the forward echelons when skin traction cannot be used because of destruction of skin by burns or trauma. Following adequate débridement in the evacuation hospital, fractures of the shaft of the femur or tibia and fractures involving the hip or knee joints are evacuated to the general hospitals in the Army half-ring splint with skin or skeletal traction or in a padded plaster spica. In this connection, the so-called "Tobruk" splint has received favorable comment. It is applied as follows: By means of traction, preferably skin traction, the extremity is pulled down, a plaster cast is applied over the traction to the thigh and leg, a half-ring splint is applied to which the traction is made fast, the extremity and splint are wrapped by several turns of plaster, and the cast is completely split. Padded posterior and lateral wire ladder splints are considered best for evacuating fractures of the

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ankle and foot. In transporting cases with fractures of the humerus from the forward echelons to the first hospital installation, such as the evacuation hospital, the Thomas arm hinged splint with skin traction or the immobilization of the arm to the side of the chest with a sling or Velpeau bandage, incorporating a padded external splint, have been found satisfactory. For evacuation from this hospital to one farther to the rear, such as the general hospital, the best method consists of a U-shaped molded plaster splint extending from the axilla around the elbow and up the outer surface of the arm and shoulder to the neck, supported by bandages and a sling. For fractures of the elbow and upper third of the forearm, immobilization is best effected with the elbow flexed by the use of a posterior wire ladder or molded plaster splint extending beyond the wrist and supported by a sling.

In the management of compound fractures in forward echelons, adequate débridement is imperative and the principles described above are followed. Whereas internal metallic fixation is at times a valuable procedure in the definitive treatment of simple fractures, its application in the emergency surgical treatment in these echelons is followed by frequent complications and failures. For these reasons, the more conservative principles of careful débridement, leaving the wound open covered with loosely placed fine mesh vaseline gauze and followed by cast or splinting with skin traction, are advocated. The importance of properly padding and completely bivalving all casts of the extremities prior to evacuation is emphasized.

Penetrating wounds of the joints are also treated by adequate débridement, removal of all loose bone fragments, irrigation of the joint cavity, and closure of the synovial membrane. The soft tissue wound down to the sutured synovial membrane is left open and covered with loosely placed gauze. Immobilization is obtained as previously described.

Because of the destructive and shattering injuries incurred in this war, particularly from land mines, amputations have been relatively frequent. In performing amputations under war conditions, there has been an unfortunate lack of familiarity with the principles of open amputation. The most common errors of judgment concern the unnecessary sacrifice of tissue, closure of the stump resulting in osteomyelitis, gas gangrene, or other infections, or a stump that is too short

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for satisfactory prosthetic fitting. All emergency amputations for trauma or infection should be performed at the lowest level possible which permits removal of all devitalized and contaminated tissue regardless of stump length. Revision of the stump in accordance with prosthetic considerations may be subsequently performed. The open (guillotine) circular method, with severance of successive layers at the level of retraction of the preceding layers is the procedure of choice, keeping in mind that the skin should not be needlessly sacrificed in order to give a neat stump. The wound must be left open using a vaseline dressing. Skin traction to the stump must always be immediately applied following the amputation and continued until healing occurs. The short flap-type open amputation may be done only in cases in which early evacuation is not contemplated and subsequent closure at the same installation is deemed possible, such as in a general hospital. All major amputees are sent to general hospitals designated as amputation centers for revision of stump or fitting of prosthesis as early as practicable after the primary amputation. Before discharge from the Army these patients are fitted with a proper prothesis and taught its use and how otherwise to care for themselves.

WOUND INFECTIONS

All war wounds may be considered contaminated. The degree of infection varies from minimal surface involvement to actual invasive infection with regional or generalized extension. While the frequency cannot be estimated accurately, the incidence of serious infection, it is believed, has not been high. The prevention and treatment of these infections consist in the application of well-established principles which have previously been repeatedly emphasized. The exact status of chemotherapy has not been completely established. It may be justifiably stated, however, that in the light of recent critical studies and more extensive experience the widely heralded and perhaps over-enthusiastic concept regarding the value of sulfonamides in wound infection must now be considerably modified. Whereas many surgeons continue to frost the wound with sulfanilamide, the beneficial effects of the drug, when applied locally, are questioned by careful observers. The critical surgeon, in our Army and in the British Army, is beginning to veer away from the local use of sulfonamides and to rely on their systemic effect to prevent general

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sepsis and spreading infection. For this reason it is recommended that sulfadiazine, which is considered the drug of choice, be administered by oral or parenteral means at the earliest opportunity after injury and continued postoperatively. At present, penicillin appears to be the most promising bacteriostatic agent in controlling wound infection. It seems to have great potentialities in military surgery. The immunization program with tetanus toxoid and the routine administration of a stimulating or "booster" dose immediately after wounding have controlled the occurrence of tetanus in the U. S. Army. No case of tetanus has occurred in an American soldier who has been properly immunized and has received these tetanus toxoid injections.

The most serious infection which continues to be a grave problem is gas gangrene, the general incidence of which thus far closely approximates that of the last war. On the basis of extensive studies on anaerobic infections of war wounds in the Middle East among British troops, MacLennon found that "neither in prevention nor treatment has much advance been made in the last twenty-five years," despite the fact that in this period "the potency of antisera has at least been doubled and the whole group of sulfonamide drugs introduced." The incidence and mortality of gas gangrene among our wounded men have been in accord with these findings. These startling observations emphasize the importance of this problem in view of the increased possibilities of anaerobic infection as fighting on the highly fertilized soil of the European continent progresses. Since the mortality (40 to 50 percent) and the morbidity in established gas gangrene are so high, the prevention of this complication is of the greatest importance. Effective prophylaxis depends on an adequate realization of the factors and conditions under which the disease is likely to develop. The underlying factor contributing to the development of this grave infection is the presence of anaerobic environment and spore-bearing bacilli of the Clostridium group and of devitalized tissue. Preventive measures should be designed toward the removal of all tissue in which the circulation is lost or dangerously impaired, the avoidance of procedures that jeopardize the vascularity of the affected part, such as unpadded unsplit casts, tight plugging of wounds, circular bandages and tourniquets, and the provision for adequate drainage of the wound. The prophylactic value of poly-

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valent gas gangrene antitoxin has not been established clinically, and its use for this purpose is not recommended. The treatment of established gas gangrene is directed toward controlling the infection and combatting the toxemia. This is best accomplished by the combined use of surgery, antitoxin, sulfonamides, penicillin, and supportive measures.

Salicylate Therapy in Rheumatic Fever

The essential problem in the therapy of rheumatic fever is the prevention of disabling heart disease. If the rheumatic attack were always monocyclic, severe heart muscle damage would rarely occur. However, in young adults and children, rheumatic fever is more commonly polycyclic and during each febrile phase of the cycle severe inflammatory reactions occur in vascular tissues and continue to occur as long as the respiratory pathogen (hemolytic streptococcus, group A) liberates antigen and induces an abnormal antibody response in the rheumatic subject. Since no methods are available for suppressing the elaboration of antigen by the bacterial agent or for modifying the constitutional defect of the host, effective handling of the rheumatic patient must depend, for the present at least, on a complete orchestration of all available therapeutic instruments. In the treatment of each patient the objective must be to reduce cardiac damage to a minimum, and to do this the inflammatory reaction of rheumatic fever must be suppressed.

The only drug that has survived for half a century in the treatment of rheumatic fever is salicylate, and yet its use is still empirical. There is no standard dosage for the use of this drug and its use in rheumatic children is frequently not advised. The reasons for this confusion in empiric salicylate therapy are apparent. Salicylate has no effect on the infectious agent and there is no evidence that it modifies the immune response of the rheumatic fever patient. To determine whether salicylate can modify the rheumatic reaction, it is essential that the active drug component be identified, its concentration in the blood stream must be measurable, and the effect of various

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Abstract of an article by Lieut. Commander (now Commander) Alvin F. Coburn, M. C., U.S.N.R., published in the Bulletin of the Johns Hopkins Hospital, December 1943.

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blood levels of active material on the inflammatory process be demonstrated.

The rate of blood sedimentation can be used in conjunction with the clinical manifestations to evaluate the result of salicylates on the rheumatic reaction.

METABOLISM OF SODIUM SALICYLATE

Kapp and Coburn have recently shown (J. Biol. and Chemistry, 145:549 1942) that the human host metabolizes salicylate with the excretion of at least four fractions. Adults and normal adolescents excrete about 4/5 of ingested salicylate in forms containing intact salicyl groups; about 20 percent of the excreted salicyl is in unchanged salicylate; about 53 percent in salicylurate; and about 25 percent in glucuronides. About 4/8 percent of the ingested salicyl is converted to gentisic acid and related compounds. Patients with acute rheumatism excrete a smaller proportion of unchanged salicylate acid than normals. Patients who give a good clinical response to salicylate and whose temperatures fall rapidly to normal show small outputs of salicylic acid for only a few days, and after the remission of fever has occurred, the amounts of salicyl excreted are within normal range. Rheumatic fever patients excrete relatively large amounts of salicyl in conjugated form, about two to four times as high as with normal subjects. Rheumatic fever patients who show the best clinical response, including those who receive salicylate intravenously, excrete a larger proportion of the drug in the form of salicyl than patients who have not responded satisfactorily. These findings suggest that some of the salicylic acid reacts with the inflammatory process and is thereby conjugated. The combined evidence is compatible with the possibility that the salicylate effect in rheumatic fever depends on the concentration of the circulating salicyl radicle.

PRELIMINARY OBSERVATIONS

A preliminary study was made on 64 patients admitted to hospital early in an acute attack of rheumatic fever, all with a few exceptions free of detectable signs of heart disease. Group 1 consisting of 43 cases received sodium salicylate only for the relief of symptoms and pyrexia. The daily regime ranged from intermittent doses to 3 to 6 gm. About 40 percent of this group treated symptomatically with sodium salicylate had polycyclic rheumatic attacks and all but three developed cardiac

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valvular disease. One patient in this group manifested a fulminating attack while being treated symptomatically with salicylate.

Group 2 comprised 7 patients with severe attacks who were treated with 10 gm. of sodium salicylate a day until their sedimentation rates remained normal for two weeks. None of these patients developed signs of valvular heart disease and all of them showed a progressive fall in the blood sedimentation rates which reached normal levels between the 15th and 30th day.

Group 3 comprised 12 patients with severe rheumatic attacks, each of whom received daily infusions of 10 gm. of sodium salicylate for two weeks. Without exception these sedimentation rates fell progressively and were normal after 14 infusions. At this time sodium salicylate in doses of 10 gm. a day was given by mouth until the sedimentation rates remained normal for two weeks. These patients escaped valvular heart disease.

Summarizing, a preliminary study indicated that about 40 percent of 43 young adults treated symptomatically with sodium salicylate manifested rheumatic activity for about one month and showed a marked tendency to develop valvular heart disease, and that of 18 patients treated with daily doses of 10 gm. or more of sodium salicylate by mouth or by vein all showed rapid clinical recovery and a progressive fall in the blood sedimentation rate. Although half of the 18 patients had electrocardiographic evidence of carditis on admission, none developed clinical signs of valvular heart disease. This study suggested that doses of 3 to 6 gm. were adequate for the relief of pain and pyrexia, but failed to suppress the inflammatory reaction; that doses of 10 gm. not only brought symptomatic relief but also modified the rheumatic reaction, and both effects were obtained most rapidly in patients receiving sodium salicylate by vein; that in exceptionally severe attacks, larger intravenous doses were required at the onset. None of these patients developed evidence of renal irritation and prothrombin determinations were normal in the six patients tested.

METHOD FOR DETERMINING PLASMA LEVEL OF SALICYLIC ACID

A method was developed by Brodie, Udenfriend, and Coburn for measuring the concentration of the salicyl radicle in

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plasma. (This was published in the *Journal of Pharmacology and Experimental Therapeutics* in January 1944.) The method was as follows:

One cc. of plasma is placed in a 30 cc. stoppered flask. To this is added 0.5 cc. 5 N HCl and 20 cc. of ethylene dichloride. The flask is agitated on a shaking machine for at least 5 minutes. An aliquot of 10 cc. is removed in a syringe with a long needle, special care being taken not to contaminate the ethylene dichloride layer with the supernatant acid water layer. The ethylene dichloride aliquot of 10 cc. is placed in another stoppered flask to which is added 10 cc. of distilled water and 0.5 cc. of 1 percent ferric nitrate. The flask is again agitated in the shaking machine for five minutes. About 7 cc. of the supernatant, purple water layer are removed. The color is matched promptly in a colorimeter against a known standard concentration of sodium salicylate in plasma which was treated in parallel with the samples to be tested. The content of salicylate in the plasma is calculated. It is convenient to use larger quantities of plasma if the salicyl radicle is below 100 gamma per cc. The content of drug in the erythrocytes is negligible.

PATIENTS STUDIED

Fifty-eight patients with attacks of rheumatic fever were studied to determine the relation of plasma salicylate levels to the effectiveness of salicylate therapy. These patients were similar to the group used in the preliminary studies and the general care administered to them was the same. All patients were treated in an identical manner except for the dose of sodium salicylate administered. It was shown that the salicylate plasma content is readily brought up to 400 gamma per cc. in four hours by intravenous administration, whereas it takes two days to develop this level with oral doses. While the plasma level remains fairly constant after the second day after sodium salicylate oral therapy, following intravenous therapy the level shows a marked drop twelve hours later. Attaining plasma levels of 600 gamma per cc. is difficult or impracticable with oral doses, but is possible when 20 grams are given by vein during a period of eight hours. It is possible to build up a plasma salicylate level, if necessary, of 650 gamma per cc. in a few hours and without causing symptoms other than mild tinnitus. At this range of blood levels, the symptoms disappeared at once, the temperature reached normal promptly, the elevated blood sedimentation rate fell within a few days and declined progressively to within normal limits which were reached between one and two weeks.

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PROPOSED TECHNIQUE FOR USING SODIUM SALICYLATE

If one can modify the sedimentation rate curve so that it ceases to rise after seventy-two hours of treatment and then falls progressively reaching normal values within fourteen days, there is good reason to believe that the rheumatic reaction has been suppressed and that further cardiac damage will be inhibited. To this end the following schedule of therapy is suggested, realizing that modification will probably be forthcoming as the series of cases so treated becomes larger.

Day 1: 10 grams of sodium salicylate in 1,000 cc. of 0.9 percent NaCl are administered by intravenous drip in four to six hours.

Day 2: If the patient has any rheumatic symptoms or if the temperature has not reached normal—20 grams of sodium salicylate are administered in 2,000 cc. of 0.9 percent NaCl in eight hours.

Day 3: This can be repeated if necessary, but with the patient symptom free and afebrile 10 grams of sodium salicylate are adequate.

Days 4 to 6: Sodium salicylate infusions are continued daily until the blood sedimentation rate has made an appreciable drop; e. g., about 20 percent.

Days 7 to 30: Oral therapy replaces intravenous treatment. Doses of 1.6 grams of sodium salicylate and 0.6 grams of sodium bicarbonate are administered every four hours day and night. A total of 10 grams of sodium salicylate is given daily during this period.

Day 30: After two weeks or more in which the sedimentation rates remain within normal limits, the patient is allowed a trial week at bed rest without any salicylate. If he remains symptom free and maintains a normal sedimentation rate for one week he is allowed up progressively and disposition is as previously outlined. If, however, the patient develops frank symptoms, fever or a marked rise in the blood sedimentation rate during this test week, another two-weeks course of therapy is indicated. This course is either begun with oral medication or one intravenous infusion of 10 grams followed by oral doses as outlined above.

Frequent blood sedimentation rates are essential for guiding this course of treatment. The Westergren method, which was used at the bedside, proved simple and adequate. Occasional plasma salicylic acid determinations are also useful. This check led to the discovery that one patient in the presnt group was discarding his drug and that another was receiving twice the dose ordered. Furthermore it is important to know: (a) whether the plasma salicylate levels to be expected with either intravenous or oral administration of the drug are attained, and (b) whether the level required for protection of the patient is maintained.

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DISCUSSION

This series of patients is small and in some cases the disease may have subsided spontaneously after a monocyclic attack. Nevertheless, the results warrant the extension of the therapeutic technique to a larger group of rheumatic patients.

Salicylic acid is not the final solution to the therapeutic problems occurring in rheumatic fever. With the development of blood level methods, other drugs may be found to be more effective in suppressing the rheumatic reaction, but like salicylic acid, these, too, may not modify the duration of rheumatic activity. To do this, one of two objectives must be realized. Either the immune response of the host must be modified so the patient recovers promptly after a monocyclic attack or the capacity of the infecting microorganism to elaborate antigen must be inhibited by a chemotherapeutic agent. Since neither of these objectives has yet been realized, one is limited to the suppression of the inflammatory process. For this purpose a high concentration of salicylate in the plasma appears to be effective.

Medical Service in the North African Campaign

MAJOR GENERAL ALBERT W. KENNER
U. S. Army

The medical service for the initial landings in North Africa began with medical planning and its correlation with the planning of the General Staff and the Special Staff. Three synchronized landings were made, one in Morocco by the Western Task Force, a second at Oran by the Central Task Force, and a third at Algiers by the Eastern Task Force. This article relates only to the Western Task Force initially and to the allied North African Force subsequently.

Early in the planning, it was realized that the desirable was also the unattainable owing to the restrictions imposed by tonnage available and that the medical service would have to be "run on a shoestring." An amphibious operation was a new experience for most of us, and I believe we were thinking in terms of commando tactics and Dieppe. However, it was decided that the first convoy would carry fighting men and their tools and such service personnel and equipment as could be reduced to the minimum to assure first and second echelon medical service. Only attached medical and skeletonized med-

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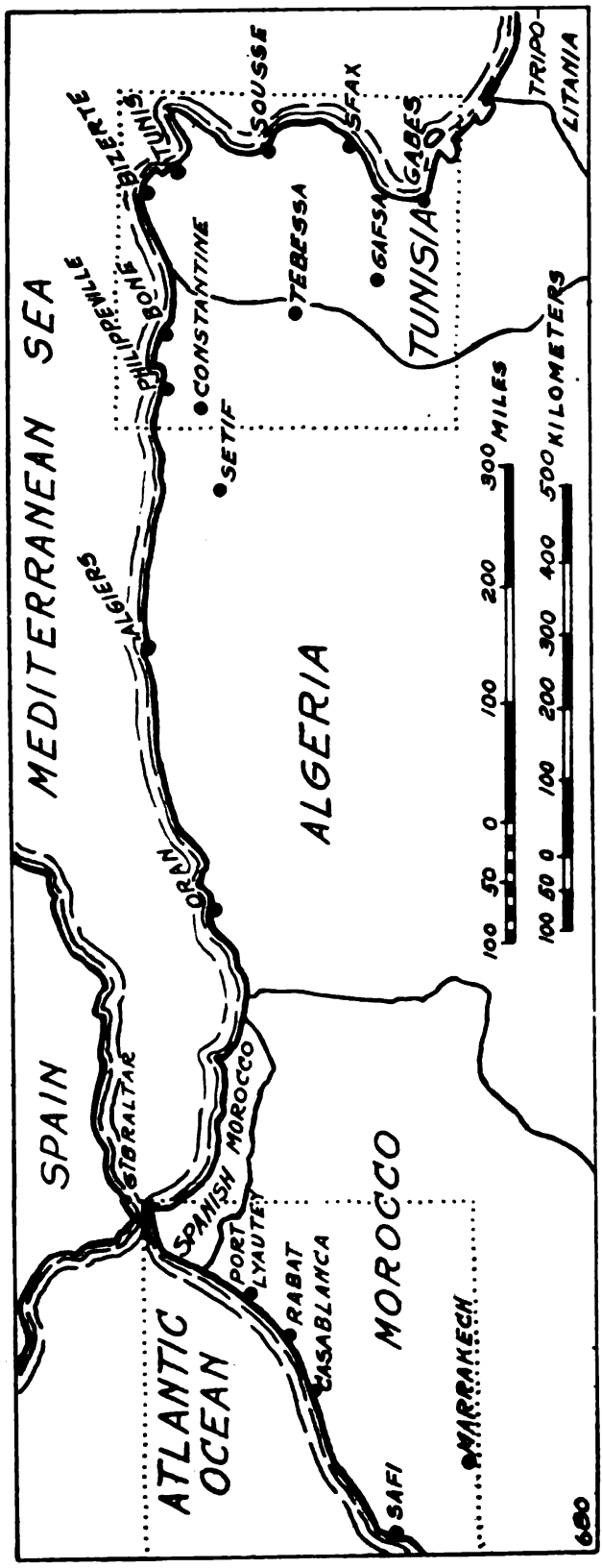

FIGURE 1. The area enclosed in dotted lines at the left is shown in more detail in figure 2.

ical battalions could be included in this initial landing force. The evacuation hospitals were on the second convoy. The fixed installations, station and general hospitals, did not arrive until the end of December.

The medical planning for this operation was expressed in the joint medical plan prepared by the surgeon of the Western Naval Task Force and the surgeon of Task Force "A." The Navy's responsibility was defined as medical care to personnel of all services between port of embarkation and high watermark on overseas landing beaches, including evacuation and hospitalization afloat. Therefore, the Army medical service became operative upon the attainment of beachheads at high tide levels. Lacking any type of Army medical unit that might afford hospitalization, all transports were equipped

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by the Navy with medical supplies and personnel necessary to assume the role of evacuation and station hospitals. All Army medical supplies and unit equipment were combat loaded and so dispersed in the convoy that each ship carried balanced stockage of unit maintenance for a thirty-day period. This was necessary to obviate loss by enemy action of large amounts of certain categories of medical supplies. Blood plasma for 10 percent of the command, special drugs, and biologicals essential for the operation augmented unit maintenance. Certain medical vehicles, organic to the medical batallion, were also combat loaded, but they were inadequate and in some instances were commandeered by officers of combat elements as they came ashore. It may be mentioned that vehicles were waterproofed and were landed in the surf from landing boats with motors running. Incidentally, some of them stayed in the surf. Insect repellents, louse powder, methyl bromide, etc., were carried by the engineers, while the quartermaster was responsible for the supply of white gasoline for autoclaves and kerosene for refrigerators.

Movement overseas phase. Hospitalization was furnished by the Navy. The senior Army medical officer on each transport reported for duty to the ship's surgeon immediately upon embarking. Army medical officers conducted sick call, made the usual sanitary inspections, and functioned cooperatively with the ship's surgeon. Naval medical personnel was augmented on each transport by a ship's platoon of Army medical personnel furnished by the port of embarkation commander. Casualty estimates, based on the assumption that the beachhead would be secured in three days (or else), were projected as a certain relatively high percentage of combat elements committed. This implied that each transport would receive two to four hundred patients, depending upon its size. Fortunately, casualty rates were relatively low, permitting the removal of these ship platoons for duties ashore after the armistice.

Landing phase. Medical personnel and equipment debarked as ordered by the combat unit commander. Medical supplies had priority after ammunition and aviation gasoline. One company aid man (medical) accompanied each company in the assault, carrying his individual equipment, two canteens of water, and a bag containing surgical dressings, bandages, etc. The battalion surgeon and the rest of the detachment landed

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with the fourth wave carrying four litters and one medical bag in each LCP (Landing Craft Personnel). Each combat group commanded detailed one medical officer and eight enlisted, from medical personnel available in his command, to assist each naval beach party in the treatment, collection, and seaward evacuation of casualties. Initially only first echelon medical service was furnished, wounded were given first aid and placed in small collecting stations in relatively protected places, back of sand dunes, depressions, slit trenches, etc., until the beachhead was sufficiently advanced to permit evacuation by landing craft. In the planning for this invasion, it was decided that casualties would be evacuated by landing craft to the transports assuming the role of evacuation hospitals. All casualties with an expectancy in excess of thirty days were to be returned to base ports, while those of lesser expectancy would be returned to shore prior to the departure of the convoy on its return to the United States. This plan was sound, but did not envisage the loss of so many landing craft or the power of a twelve-foot surf. The beach was enfiladed by artillery and strafed by planes. As a result few cases were evacuated seaward during the first two days. Subsequently, with the securing of the harbor of Fedala, evacuation was accomplished as planned.

In the afternoon of the first day, one clearing platoon was established in a casino on the beach where Army and Navy surgeons, under blackout conditions and with field equipment only, rendered the necessary medical service. It was there that the lifesaving properties of blood plasma and the efficiency of the sulfa drugs were demonstrated. As a digression, the writer met an officer a few weeks ago, now on active duty, who was shot down over Fedala that eighth day of November, incurring a compound fracture of both bones of the right leg and five .30-caliber gunshot wounds. He was treated in the casino and later sent to the United States by the returning convoy. He had an uneventful recovery, his fractures healed without deformity or impairment of function, and he stated that he had had no infection. In this casino, with its handful of doctors, over four hundred burned sailors were treated during one night. One hundred of them were so badly burned that they had to be given repeated transfusions with blood plasma. Only two died during the time they were under treatment by this little group. Two more died subsequently aboard naval vessels. Since the casino, including the porches, could

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accommodate no more than 150 litter cases, schools and other public buildings in the town were taken over and surgical wards established, staffed with men from a collecting company. French families received and nursed some of the wounded. Despite the lack of facilities, the mortality rate among wounded reaching this clearing station was remarkably low.

At first the patients were subsisted on the "K" ration; after a few days, however, the "B" ration was available and liquid diets were prepared for them. Initially, also, and until the engineers could land water purification units and establish water points, all water used for drinking and cooking was landed in five-gallon cans from transports. All personnel debarking carried two canteens and a tube of twelve "Halazone" tablets for the purpose of purifying water obtainable from local sources. This was a fortunate provision since the water supply of the entire region was obtained from springs in the Mamora Forest, 140 kilometers to the north, and conducted by mains along the coast. During the bombardment by our naval guns, the water main was broken in numerous places.

A brief presentation of the tactical situation as of 8 November 1942 will facilitate an appreciation of the medical problems encountered. The approximate strength and disposition of enemy troops was known prior to departure from the United States and it was patent that the element of surprise was essential for the successful accomplishment of the mission. The Western Task Force was well supported by the Naval Task Force and had adequate air coverage. Operationally it was divided into three task forces for the landing. The main objective of the entire force was the capture of Casablanca. Subtask force "X" had as its mission the capture of Mehdia-Plage and Port Lyautey Air Field by 1200, the capture of the air field at Sale 40 kilometers to the south, and the security of the left flank of the major force. The "Y" force was to make the main effort. Its mission was the establishment of the beachhead at Fedala, the capture of the town, and the initiation of the operation designed to capture Cacablanca. The "Z" force had as its missions: capture Safi, secure crossings, contain enemy elements known to be garrisoned at Marrakech, and aid in the capture of Casablanca by envelopment. These three forces were not mutually supportive and were separated by considerable distances. It is 130 kilometers from Port Lyautey to Casablanca and over 250 kilometers from the latter place to

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Safi. To cover these distances there were available eight ambulances of the cross-country type and twelve armored ambulances (M-3, half-tracks). The medical service for the entire force was rendered by attached medical troops, two and one-half (five platoons) clearing companies, and three collecting companies. Personnel consisted of 102 Medical Department officers and 1,418 enlisted, including ships platoons—and no nurses. Naval fire support groups supported the ground

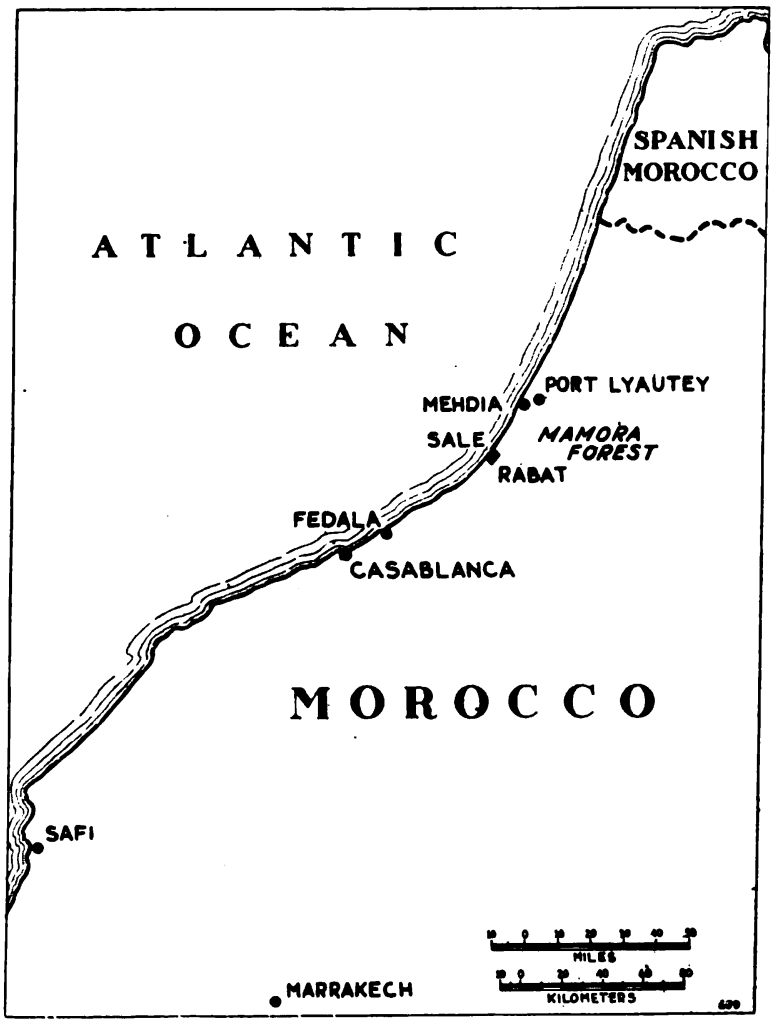

FIGURE 2

attack during daylight on call from battalion landing teams and without call against hostile defense installations. The Naval Task Force was also responsible for containing and destroying the enemy fleet in Casablanca harbor and any others that might be coming from the south or north. The naval air group attacked enemy air and naval craft in Casablanca, made reconnaissance of the area commencing at daylight, and exe-

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cuted bombing and strafing missions against enemy troops. By the grace of God and a disinclination on the part of some elements of the enemy forces to make more than a half-hearted effort, all objectives were seized without unusual losses.

Reconstruction period. Following the armistice, the re-establishment of the traditionally amicable relations that had characterized the intercourse between ourselves and our erstwhile enemy became a major concern. The civil and military population was divided against itself politically into three major groups. In order to insure against political chaos, it was essential that the current government in this protectorate be supported, bearing in mind that one of the main reasons for securing Casablanca was the development of an Atlantic base to assure the supply of our troops in North Africa in the event of a closing of the Straits of Gibraltar by enemy action. We could not fight a hostile populace and accomplish that mission with the force available to us. Immediately, therefore, liaison was established with civil and military authorities and the *entente cordiale* cultivated.

Our wounded in military hospitals were transferred to our own medical facilities as they were developed. Large public buildings were taken over and converted into military hospitals. The two evacuation hospitals that arrived in the second convoy were diverted from their normal function and established a general hospital at Casablanca and a station hospital at Rabat. They functioned in their respective capacities until the arrival of station and general hospitals in subsequent convoys. It will, therefore, be appreciated that the Western Task Force had a dual role, the security of this vast area and the establishment of a major base. The surgeon, therefore, had to act as a service of supply surgeon and as a surgeon of a field force.

One of our immediate tasks was the establishment of sanitated zones in all areas occupied by our troops. This could only be accomplished by enlisting the support of public health agencies and arranging a coordinated program of disease control and sanitation. With this in mind a conference was held with representatives from the indigenous civil and military medical authorities a few days after the armistice and the initiation of the indicated planning effected. The public health agencies of Morocco were well organized and directed but lacked many items necessary for the accomplishment of their

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purpose. They had no gasoline for their vehicles, no Paris green, no oil for spraying, and lacked many drugs needed in the treatment of communicable diseases. These items had to be furnished by us since they had no communication with the mother country. During our planning for the invasion we had received information relative to the endemic areas and prevalent diseases, and so had included adequate supplies of the necessary medicines. We had arranged with the engineers for the shipment of screening material, insect repellents, and insecticides; all personnel was immunized prior to embarkation against those diseases for which we had protective sera and vaccines, and an effort was made to indoctrinate combat personnel with the necessity of close adherence to prescribed sanitary procedures by informative talks and circulars. We knew that venereal disease, malaria, and typhus fever were rampant throughout the area, that cholera and dysentery, both amebic and bacillary, attained epidemic proportions in certain areas, and that plague was a constant health menace at all ports. By arrangement with the health authorities, military and civilian, reports on the incidence of the communicable diseases were sent to the surgeon, Western Task Force. In one instance thirteen cases of plague developed in a suburb of Casablanca where our troops were billeted. The troops were immediately moved from that area. Appreciating the difficulties inherent in any attempt to sanitate all of Morocco, a sanitated zone two miles in depth was established around all areas where troops were bivouacked or billeted.

It was impossible to secure enough buildings to billet all troops as all of the cities in Morocco were overcrowded with refugees from France, Southern Europe, and the African Mediterranean littoral. Casablanca, having a normal population of 80,000, was housing 200,000. Sanitary facilities were inadequate. There were many open sewers and the water carriage system evacuated its contents into the sea where the tide washed everything back on the beaches. The water supply was inadequate and always under suspicion as in the dry seasons the Arabs frequently broke the conduits to create pools for watering stock. Amebic dysentery attained epidemic proportions in several areas. In Fez in one month over fifteen hundred new civilian cases were diagnosed. During certain seasons the flies are so thick that they fly into the mouth when one is speaking. This applies particularly to Tunisia in the region

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from Sfax to Gabes where bacillary dysentery epidemics begin about the middle of April and continue throughout the summer. Since the Arab uses his right hand for eating and in accordance with the religious precepts defined by the Koran, eschews the use of knife and fork, the transmission of the enteric diseases is facilitated. The ubiquitous Arab is usually infested. Since the war, there have been practically no importations of cotton or woolen goods into Morocco and the Arabs have been hard-pressed to secure material to cover themselves. Typhus fever finds, therefore, a fertile field among these people and many of them die yearly from this disease.

* * *

Venereal disease was very prevalent in all of the larger towns and cities, probably because of the large transient population of refugees leading a hand-to-mouth existence. As expressed by the chief of police in Casablanca, all prostitutes, clandestine and otherwise, fall into three main infection categories: the *poule de luxe,* usually the friend of an official and therefore protected, 25 percent infected; the waitress and barmaid, 50 percent infected; and the Arab woman, 100 percent infected. The prostitutes in the government-controlled "medina" probably have the lowest incidence, around 10 percent. With an exchange rate of seventy-five francs to the dollar, the American soldier belonged to the privileged class, to the obvious envy and discomfiture of the underpaid French soldier. Venereal disease rates were kept within bounds, in so far as white troops were concerned, by the application of the usual control measures.

Despite all of these health hazards the rates for sickness compared favorably with those obtaining among troops in the continental United States. The medical facilities of the base developed as convoys brought in additional medical troops and equipment. Medical supply depots were filled to a forty-five-day level, a laboratory was established and an efficient medical service established. The Atlantic Base Section became an entity with the arrival of its commanding officer and staff, and was divorced from the Western Task Force.

(To be continued)

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Nutritional Aspects of Convalescent Care

The Committe on Convalescence and Rehabilitation of the National Research Council issued a special report, dated 1 February 1944, which is devoted to the role of nutrition in convalescence. This subject is of such importance that the report, in large part, is reproduced here.

REPORT OF COMMITTEE

It may be assumed that the soldier or sailor who has subsisted on normal service rations is in an excellent nutritional state up to the time he becomes disabled by illness or disease. Exceptions must be made of men who, because they were isolated when they incurred their disability, had not received full rations.

As soon as injury or disease occurs, malnutrition almost always begins. This is the result of two processes: first, "toxic destruction of protein"—i.e., the direct effect of disease or injury in promoting destruction of tissues; second, diminished intake of food, because of inability or disinclination to eat. Both of these processes bear some relation to the severity of the injury or disease.

Although some wastage of tissue can be tolerated and has no easily demonstrable effect on strength and efficiency, the extent of such "harmless" deficiency is ill-defined. There is ample evidence that any considerable nutritional deficiency is distinctly harmful: it first reduces tolerance for exceptional exertion; in its most severe form it is altogether incapaciting. Even a mild degree of malnutrition should, therefore, be prevented because, though its evil effect may be undetectable, it marks a step toward incapacity and each step makes physical efficiency more precarious.

The "toxic destruction of protein" can be alleviated only by effective treatment of the disease or injury from which it orginates. Its evil effects are, however, exaggerated by inadequate dietary intake. Wasting from this cause can be prevented in a large proportion of patients, and even "toxic destruction of protein" may be reduced by the effective ad-

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ministration of fluid and food in proper quantities and proportions. In addition, by improving the general state of health these measures promote and shorten the processes of repair.

Attention is likely to be given to the dietary needs of those who are suffering from serious diseases and injuries, although the regime may not always be wisely directed. From a military standpoint more man-days could be gained by accelerating the recovery of those with less grave conditions who may be rapidly returned to active service. Every effort should be made, therefore, to prevent malnutrition and minimize wasting in acute or minor casualties as well as in men with more serious disabilities.

The average medical officer is so preoccupied with the specific treatment of the disease or injury which confronts him that he is prone to overlook details of dietary management, especially when there are no urgent indications. In addition, even if he has the best will in the world he may be insufficiently acquainted with fundamental principles of nutrition. For both these reasons it would be well, in hospitals with a sufficiently large staff, to place the responsibility for general supervision of dietary management and nutrition of patients on a particular member or members of the medical staff of the hospital. These nutritional medical officers should not order diets for all the patients in the hospitals, but they should rather act as instructors and consultants to the medical officers in charge of wards and should see that good dietary principles are observed throughout the hospital.

Outlined below are the general principles underlying nutrition, knowledge of which may be expected to enable the medical officer to mitigate wasting and to accelerate recovery of patients.

Emphasis should be placed on the importance of prevention rather than correction of nutritional deficits. The proverb, "An ounce of prevention is worth a pound of cure," is nowhere more applicable than in the field of nutrition. By focusing his attention on the diets at the very onset of illness, the medical officer can avoid the necessity of treating the serious effects of prolonged malnutrition.

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GENERAL PRINCIPLES

Obvious but often overlooked is the fact that *food offered to a patient is of no value unless it is eaten.* The amount of food actually consumed should be ascertained. If food offered to the patient is not eaten, the reasons must be learned and, if possible, corrected. Anorexia must be regarded as a challenge, not as an inevitable and irremediable consequence of disability. Although patients should be encouraged to eat as varied a diet as possible, idiosyncracies cannot be altogether neglected. Failure to eat may arise from physicial weakness, exhaustion, or the fact that the necessary motions are painful. It may be necessary to feed patients under these conditions. Fluid or semisolid diets may be essential for seriously ill patients. In the absence of gastro-intestinal disturbances patients who will drink freely can usually be given adequate protein and calories in the form of fluids if advantage is taken of the sense of thirst. This sense should not be too much dulled by water and non-nutrient fluids; nutrient fluids should be made available to quench it. Thirst may be stimulated by the intelligent use of salt (see below). But fluid or semisolid diets, because they are not conducive to appetite, should not be continued if the patient is able to take solid food. The chief reason for giving fluids, semisolids, and soft foods to the sick is to relieve them of the work of cutting or masticating the foods. All foods become liquid in the gastro-intestinal tract except milk, which first coagulates in the stomach. In some conditions frequent feedings are desirable; in this case the total diet is best divided equally into the required number of meals. Intermediate feedings (between meals of a regular dietary) may only spoil the appetite for the regular meals. Night feedings, shortly before sleep, are usually well tolerated; high calorie feedings, instead of the usual light fluids, may be given to advantage at this time.

It is also obvious that, whenever possible, the patient should eat his necessary food in the normal way. It is not only unnatural but laborious for the doctor and distressing to the patient to meet all dietary requirements by means of other devices. Tube feedings or parenteral injections should not be employed merely as a means of evading the difficulties which arise from simple anorexia. On the other hand, these two methods are preferable to malnutrition and should

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be used when indicated. Their use, indeed, should make it possible to avoid malnutrition even if the patient is unable to take any food or fluid by mouth.

DIETARY ESSENTIALS

Water. Enough water must be given to provide for insensible and sensible perspiration and for the production of sufficient urine to enable the patient to excrete the waste products that must be eliminated, without depleting the essential water-stores of the body. Loss of water by the skin varies with the environmental temperature and the total caloric expenditure. The best criteria of an adequate water supply are:

1. The volume of urine, which should not fall below 1000 cc. in febrile patients.

2. The specific gravity of the 24-hour urine, which should not exceed 1.020.

3. Normal elasticity of the skin and subcutaneous tissues, moist appearance of the tongue, and the absence of uncomfortable subjective sensations of thirst.

Forcing fluids—i.e., inducing a patient to take uncomfortably large quantities of plain water—is seldom indicated. It is tiring and distressing to the patient and often impairs appetite. If a large intake is necessary, enough salt should be given to promote thirst.

Salt. Animals derive their sodium salts almost entirely from sodium chloride added to their food. If the sodium salts of the body become depleted, water is not properly retained, and dehydration results. In addition, sodium deficiency promotes circulatory failure. Patients with sodium depletion lose thirst, appetite, and strength. If the sodium deficit becomes great, circulatory collapse may supervene.

Normal kidneys conserve sodium and chloride most efficiently. Chloride practically disappears from the urine as soon as its concentration in the serum falls appreciably below normal. If the urine contains little or no chloride (that is, yields little precipitate when treated with silver nitrate), it may be presumed that there is a salt deficiency. An exception must be made of patients with gross renal insufficiency, lobar pneumonia, advanced chronic tuberculosis, and

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other destructive pulmonary diseases. In these conditions the kidneys do not retain their normal capacity to conserve salt. Consequently, urinary chloride excretion may continue after serum chloride has fallen below normal limits.

The insensible perspiration (fluid lost through the lungs and by the skin without sweating) amounts to 1,000 to 1,500 cc. and contains no salt. Sweat and exudates do contain salt that must be replaced. The stomach has no regard for the salt content of the body. Vomiting therefore causes loss of salt, which does not cease even when serum sodium and chloride are depleted. Administration of water (ice is water) by mouth in the face of persistent vomiting only washes salt from the body and enhances dehydration, as does continuous gastric suction and lavage. For lavages of all kinds, normal salt solution, not water, should be used.

All persons, unless they have congestive heart failure or nephritis with edema, should receive at least 5 gm. of sodium chloride daily. The average normal diet contains more than this. If, however, patients do not eat enough of their diets or subsist chiefly or entirely on simple fluids, containing only carbohydrate, extra salt should be given. This may be introduced in broth, tomato juice, or even milk and fruit juices. Administration of adequate amounts of salt will often increase the intake of both food and fluid by creating appetite and thirst. Salt depleted patients will not eat or drink well.

Protein is indispensable; it cannot be replaced by any other food. A normal subject, starving, loses about 1 gm. of tissue protein per kg. of body weight per day. This deficit can be reduced to 0.3 to 0.5. gm. by the administration of high calories in the form of carbohydrate and fat; it cannot be prevented entirely. Moderate amounts of carbohydrate alone will reduce protein loss considerably. In acute febrile diseases and after serious injuries protein wastage may rise to 3 or more gm. per kg. of body weight per day. This can be reduced only slightly by feeding carbohydrate. There is evidence that the lost tissue protein can be partly or wholly replaced and consequently that wasting can be mitigated or prevented by the administration of large amounts of protein and sufficient amounts of carbohydrate and fat to provide for the caloric requirements of the patient. This is a matter

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of great importance, since loss of tissue protein sacrifices the substance of liver and other important organs. It also results in depletion of serum proteins (hypoproteinemia), which ultimately leads to nutritional edema.

Every effort should be made to prevent this loss by administration of diets containing adequate amounts of protein of high biological value containing all the essential amino acids in proper proportion. For this purpose milk and eggs (the latter preferably cooked) may be used if patients are unable to take solids. Ground meats may, however, be given earlier and more freely than is general believed.

Diets for sick or injured persons should contain 100 gm. or more of protein daily. Nothing less than 1 gm. of protein per kg. of body weight per day can be regarded as a safe subsistence ration for a normal adult.

Carbohydrate. A small amount of carbohydrate, perhaps 100 grams per day, is required to prevent ketosis in man. If this is not given, protein is broken down to provide carbohydrate. Granted sufficient protein and this minimum of carbohydrate, well-nourished subjects can derive most of the additional calories needed from body fat without serious injury.

Fat. The least important element of the diet in acute disease is fat. Indeed, fat comprises the only large store of calories on which the body may draw without depleting essential tissues. In prolonged wasting conditions, however, fat deposits may become exhausted. It is, therefore, advisable, if possible, to prevent excessive loss of fat by giving high calories. For this purpose fat itself is peculiarly suited because it provides the greatest number of calories in the smallest bulk. The digestive system of most ill or injured persons tolerates, digests, and absorbs fat well if it is given in palatable form with suitable carbohydrate vehicles. Nevertheless, if there is a limitation of the amount of food a patient can take, it is far better to give precedence to protein.

Vitamins. Starving animals appear to develop at first no vitamin deficiencies because for short periods they derive adequate vitamins in suitable proportions from their tissues. However, vitamin deficiencies develop after considerable

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periods on inadequate diets. The utilization or excretion of certain vitamins may be specifically increased by particular diseases, especially those which accelerate metabolism. Nothing is as effective in preventing vitamin deficiencies as a generous mixed diet. Complete oral mixtures of vitamins, especially brewers' yeast and other satisfactory preparations of vitamin B elements, when given in adequate quantities, may destroy appetite for food. They should, therefore, be used with caution as supplements to diets. Although complete vitamin mixtures for parenteral injection are not available, some important vitamins may be given readily.

Although a full, well-balanced diet best meets nutritional needs, it is frequently impossible for the injured or sick to take such a diet. It then becomes necessary to give priority to the food elements which are most urgently needed.

The following table lists in order of importance the various dietary constituents and the amounts of each which are required.

	Minimum need	Average requirements in sick patient
1. Water	2,000	3,000 cc.
2. Salt	5	10 grams
3. Protein	75	100-150 grams
4. Carbohydrate	100	100-300 grams
5. Fat	(see discussion)	(see discussion)
6. Vitamins	" "	" "
7. Calories	" "	" "

In patients previously well nourished, suffering from a disability or illness of short duration no serious harm develops from failure to maintain a high caloric or fat intake, since the necessary calories will be derived from body fat if the minimum requirements for water, salt, protein, and carbohydrate are met. When the patient is undernourished and the illness is long drawn out, fat stores may be depleted. The maintenance of adequate caloric intake then changes from a merely desirable part of therapy to a matter of more urgent importance.

If a patient had ample stores of vitamins before becoming sick, special effort to supply these essential elements is not necessary during most acute illnesses. If the patient had been previously depleted of vitamins or is unable for a long period to take a balanced diet, vitamins should be administered.

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TUBE FEEDING

Feeding by stomach tube is not a satisfactory procedure. Insertion of the tube is time consuming for the doctor and often not pleasant for the patient. In unconscious patients the possibility of aspiration of injected material into the lungs introduces an element of danger.

In general, tube feeding should not be used until an honest effort has been made to have the patient eat. Such effort includes provision of palatable food of a type most appealing to the patient and some personal attention by the physician to overcoming the patient's distaste for food. When gavage is used, it should always be done as a temporary expedient with the patient's full knowledge that it will be discontinued as soon as he eats an adequate amount. However, there are clinical situations in which tube feeding is the only practicable means of preventing serious malnutrition of the patient. It may be necessary to resort to this procedure when the amount of nursing and other ward assistance is limited so that personnel is not available to spoon-feed patients who are unable to feed themselves. In most instances the nasal route should be used for insertion of a moderate-sized tube, and the tube should be allowed to remain in place with regular feedings administered at two- to four-hour intervals.

The material inserted through a feeding tube should always be warmed to body temperature. Large volumes and rapid rates of injection should be avoided. The material should be concentrated and should contain the necessary amounts of salt and protein, as well as carbohydrate and fat for the provision of caloric needs, as for any well-balanced diet. . . .

PARENTERAL FEEDING

Parenteral injections are to be looked upon as temporary substitutes for normal eating, should never be used in the absence of specific indications, and should never be regarded with complacency. However, all physicians are familiar with the great benefits which have accrued from the availability of methods for the parenteral administration of water and salt to patients unable to take these essential substances by mouth. Under many circumstances the provision of other nutrient materials parenterally has as great importance for the welfare of the patient as does the parenteral administration of fluid.

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Parenteral feedings should be planned always with the view of introducing, in the smallest practicable volume of fluid, in the shortest time, the quantities and proportions of materials required to meet the needs of the recipient as they have been outlined above. Administration of excessive amounts of fluid over unnecessarily long periods distresses and exhausts patients and wastes material and the time of attendants.

Water is the vehicle for all parenteral nutrient materials. At times, however, it may be necessary to give some water in addition to the amounts required for solvent purposes. In this case, since pure water cannot be injected, glucose solution must be used. The glucose is burned, providing calories, while the water is left in the body. The proportions of sugar and water may be varied in accordance with the needs for these two constituents.

Enough water should be given to replace water lost by insensible and sensible perspiration, vomiting, diarrhea, and exudation and in addition sufficient to provide 1,000 cc. of urine (1,500 cc. if there is high fever and reason to suspect excessive toxic destruction of protein). It is impossible to state with accuracy the exact amount needed because of the wide variation under different clinical conditions. However, when a patient is unable to take any fluid by mouth, his minimum requirements will rarely be less than 2,000 cc. per day and will usually be 3,000 cc. or more.

Salt. The salt requirements of an individual can be adequately supplied over moderate periods of time by the injection of an adequate volume of isotonic solution of sodium chloride. The ratio of chloride to sodium is higher in such solutions than it is in body fluids, but if enough is given to produce an adequate volume of urine, the kidneys will excrete the excess chloride, while retaining sodium to form the necessary bicarbonate. Sufficient potassium, magnesium, calcium, and phosphate will be obtained from destruction of tissues.

A minimum of 5 gm. of sodium chloride a day should be given to all patients. Febrile subjects or persons who sweat excessively should receive additional amounts. In case of vomiting, enough should be given to replace salt lost in the vomitus. In subjects receiving water by mouth vomitus may

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be estimated to contain the equivalent of about 5 gm. of sodium chloride per liter. In subjects receiving no water by mouth, fluid lost by vomiting should be replaced by an equal volume of saline. If the patient has become dehydrated by vomiting before treatment is instituted, enough saline should be given at the onset of therapy to repair the deficit; this may require as much as five to ten liters of salt solution.

In addition to the saline, sufficient water should always be given in the form of glucose solution to provide for the insensible perspiration which contains no salt. This amounts usually to from 1,000 to 1,500 cc. daily, depending on the size and metabolism of the subject.

Glucose. A certain amount of carbohydrate is required to prevent ketosis and to mitigate nitrogen loss. Glucose solution also permits the administration of appropriate amounts of water without salt. As little as 100 gm. of glucose a day will prevent the gross ketonuria of starvation (i.e., excretion of enough ketones to yield positive nitroprusside tests in the urine) but will not prevent rise of ketone bodies in the blood. It is better to give glucose in 2 doses than 1, in order to insure continuous utilization. To provide enough calories to minimize protein wastage, more than 100 gm. daily are required.

Only 5 percent glucose should be used subcutaneously. Concentrations from 5 to 50 percent may be injected intravenously. It is generally held that solutions stronger than 10 percent should be used only in small quantities in conditions of emergency because such solutions are likely to cause venous thrombosis. Concentrations as great as 15 percent may, however, be used if they are introduced slowly enough and if there is a free flow of blood around the needle in the vein into which they are injected. A free flow of blood and slow introduction of fluid dilutes the solution at the point of injection to an innocuous concentration.

Glucose can be added to solutions of salt and to protein hydrolyzate without consideration of its osmotic contribution, provided it is injected so slowly that the glucose is utilized as rapidly as it enters the body.

The report proceeds to consider the parenteral administration of preparations of proteins (which are discussed below), of fats (which are not available at present), and of certain vitamins, namely, thiamine, riboflavin, niacine, and ascorbic acid.

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GENERAL DIRECTIONS FOR PARENTERAL FEEDING

It is best to plan in advance the quantities of water and other constituents that will be required for the day, the times at which they are to be given, and the routes by which they are to be administered. The total amounts of each component should first be estimated, after which they are translated into terms of parenteral materials that are available. Efforts should be made to use no more water than the patient requires.

Only isotonic solutions should be given subcutaneously, that is, normal saline or 5 percent glucose. The intravenous route is to be preferred to the subcutaneous for glucose solutions, since glucose tends to abstract water from the tissues at first because it diffuses more slowly than salt does. Saline solutions should not be reinforced with glucose for subcutaneous injection because this makes a hypertonic solution. Glucose can be added, as desired, to intravenous solutions because it is consumed, leaving only water. The temporary osmotic effect it produces is negligible or may be advantageous. If it is impossible to prepare the solutions fresh according to prescription, the desired concentration of glucose may be made up by the addition of the required amount of sterile 50 percent glucose from ampules.

Solutions no stronger than 10 percent of glucose can be administered at the rate of 9 cc. or about 150 drops per minute. If 15 percent glucose solution is used the rate should be reduced to 6 cc. or about 100 drops per minute. As a further precaution against venous thrombosis, the smallest possible needle (22 to 26) with a short bevel should be used, and care should be taken that it is held in place in such a way that the blood flow in the vein around the needle is not obstructed.

PARENTERAL ADMINISTRATION OF PROTEIN

As a means of supplying protein, especially by parenteral administration, casein hydrolyzates are discussed in paragraphs of the Committee's Report which are here omitted because such substances are not available at present for general distribution. A brief summary of the subject is given below.

The need for filling protein requirements temporarily by parenteral administration has been increasingly appreciated for a quarter of a century. The replacement of lost plasma proteins and the maintenance of normal blood volume have been primary

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considerations, but nutritional needs which cannot be filled by immediate oral feeding have been coming to the fore. Until recently transfusion of blood or plasma has been the only available method of giving protein intravenously. Hemoglobin does not replace tissue protein, but each liter of blood or plasma contains approximately 40 grams of protein which are metabolized and hence are a source of nitrogen nourishment. Whole blood is obviously unsuitable as a continued source of such nourishment. The use of the large quantities of plasma which would be required to maintain nitrogen equilibrium is conditioned by its availability and cost.

It is known that human nitrogen requirements can be supplied for long periods by infusion of pure amino acids or hydrolyzates of certain high-grade proteins. Such infusions represent a more physiological method than plasma transfusions because food proteins normally reach the blood only after hydrolysis. Mixtures of pure essential amino acids suitable for injection appear to be the ideal medium, but they are available only in minute quantities and at great cost. Various hydrolyzates are available, but to date only one, the product of a single manufacturer, is believed to have been shown to be safe, well utilized, and capable of maintaining nitrogen equilibrium in man.* This material is prepared by the digestion of casein with pancreatic enzyme. The casein hydrolyzate in question is usually administered in 5 percent concentration dissolved in 5 percent glucose solution. Solutions prepared for intravenous use are commercially available in limited quantities. Although such solutions can be prepared locally, the technique is troublesome and should be avoided. The basic needs of a normal man for protein would be met by between 1.5 and 2 liters of 5 percent Amigen solution a day. The solution *must* be given slowly—not more than 500 cc. of a 5 percent solution in an hour to an adult of normal size; rapid administration causes nausea and retching. It should always be borne in mind that parenteral feeding is only a temporary substitute for normal eating.

The Committee's Report also points out that casein hydrolyzates in powdered form can be utilized to provide adequate nitrogen intake by mouth in cases in which whole protein is inadequately digested, as in diarrhea. It is said that hydrolyzed protein can often be assimilated by sick patients in much larger

*This product is known as Amigen. It is probable that other preparations will be developed and shown to be satisfactory by proper testing before long.

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amounts than whole protein. Powdered hydrolyzate can be given by nasal tube, if necessary. For oral use, the hydrolyzate does not have to meet the very strict requirements of preparations for intravenous injection.

Amount of Protein Required

The importance of a constant positive nitrogen balance in wound healing and in resistance to infection has been well established by extensive clinical and laboratory study. While it is generally agreed that during convalescence every effort should be made to maintain a positive nitrogen balance by oral feeding of protein foods, there are many instances when adequate intake by this route is impossible. In practically all cases of severe injury or illness and following major surgery, an interval of days or weeks may elapse before oral feeding of protein in adequate amounts is possible.

Early investigators of protein metabolism determined the chemical structure of amino acids and established their role as the building stones of protein. Ten amino acids are considered essential to life and growth and the synthesis of these amino acids has been accomplished. When amino acids in proper mixture are given orally or parenterally, synthesis to blood and tissue protein occurs and when given in adequate quantity, positive nitrogen balance results. The essential amino acids and some of those which may be synthesized by the body (nonessential) along with polypeptides are contained in the enzymatic hydrolyzates of casein. An enzymatic hydrolyzate of casein and pork pancreas[1] has been produced in quantity and used extensively in experimental and clinical work.

The pure crystalline amino acids have been produced in small quantity for experimental study. The crystalline amino acids may be injected in higher concentration and at a more rapid rate than casein hydrolyzate, thus facilitating the administration of the desired amounts in brief injections of one to two hours' duration. Although these and possibly other ad-

1. Amigen.
Abstract of an article prepared by Lt. J. F. Conner, M.C., U.S.N.R., and published in the Navy Department BuMed News Letter, 3 March 1944.

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vantages appear to establish the crystalline amino-acid mixtures at the preparations of choice for parenteral nitrogen administration, these substances cannot now be produced in sufficient quantity for general clinical use.

The nitrogen loss in severe burns is often as much as 30 gm. per day. A total protein deficit of 2,000 gm. occurring in one severely burned patient required the administration of 6,000 gm. of protein before nitrogen balance was attained, plasma protein regenerated, and clinical edema relieved.

Following major surgical procedures, 20 to 25 gm. of nitrogen may be lost per day for a variable period of time. Gastro-intestinal surgery attended by dietary restriction over an extended period gives rise to large protein deficiencies. Nitrogen deficits are frequently observed in cases of peptic ulcer when accompanied by impaired ingestion, obstruction or hemorrhage, in severe colitis, and in malignancies of the gastro-intestinal tract.

Severe wounds and fractures are accompanied by nitrogen deficits of varying degrees related to the amount of tissue destruction and loss of blood and plasma. Postoperative wound disruption occurs more frequently in patients having low plasma proteins.

Whipple found that when hemorrhage occurs the regeneration of plasma proteins is retarded. He believes this to be due to a priority which the regeneration of hemoglobin appears to have on available protein. Primary attention must be given to the rapid return of hemoglobin to normal levels, by repeated transfusions if necessary, before satisfactory plasma regeneration and nitrogen balance can be expected.

Nitrogen deficits of varying degree relative to the severity of the infectious processes have been observed. Further study of amino acids may reveal specific combinations of these units as most efficacious in the formation of antibody factors. The action of the chemotherapeutic agents, the sulfonamides and penicillin, has been observed to be enhanced by the maintenance of nitrogen balance. Thus the desirability of optimum protein intake during infections extends the field of application of amino-acid preparations to many serious, acute, and chronic surgical and medical conditions, in which an adequate amount of protein cannot be taken orally.

The exact protein requirement of a patient can be calculated by determining the nitrogen balance, which determination, unfortunately, is not practicable for general clinical

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application. However, for practical purposes, simple principles permit a satisfactory approximation of the amount of protein required.

To arrive at this approximation one must know (1) the physical condition of the patient, (2) the past dietary history, (3) the severity of the injury or disease with respect to protein loss and destruction, (4) the patient's normal daily protein requirement calculated on the basis of one gram of protein per kilogram of body weight.

As previously indicated, the nitrogen loss in the urine alone may be as much as 30 grams per day. In terms of protein loss, this amounts to 6.5 times 30 or 195 gm. Hence, the protein required for an individual patient whose normal weight is 70 kg. will range from 70 gm. to 200 gm. The amount to be administered, selected from within this range, may then be decided on the basis of such knowledge as indicated above.

When the approximate protein requirement has been thus estimated, the amount of amino-acid substance to be given parenterally may be calculated by subtracting from the total requirement the whole protein which the patient is able to utilize by the oral route. The balance is the amount to be supplied as amino-acids. For practical purposes one gram of amino acid substance (Amigen) may be regarded as equivalent to one gram of protein.

In order that the protein administered may be used entirely for regeneration of blood and tissue protein, it is necessary to meet the patient's basal caloric requirements with glucose. However, Elman found that, in the well-nourished person, nitrogen balance can be maintained and ketosis prevented, on administration of amino acids when as little as 25 percent of the basal requirement is covered with dextrose, the remaining 75 percent being supplied by catabolism of body fat.

Administration of such mixtures parenterally may be by separate multiple injections at convenient intervals or by continuous intravenous drip during the 24-hour period.

No serious nor anaphylactic reactions due to amino-acid preparations have been reported. The most frequent reactions observed are flushing, headache, nausea, and vomiting. These reactions are related to the speed of injection and occur at slower rates of injection of the hydrolyzates than of the crystalline amino acids.

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Surgery on the Knee Joint

Experience with elective surgery on the knee joint has been disappointing from a military point of view. It seems appropriate therefore to analyze the causes of the poor results and to outline a policy to be followed in cases with internal derangement of the knee.

REASONS FOR FAILURE

The high incidence of disability following the removal of semilunar cartilages is due to several factors:

1. Selection of cases. Surgery for internal derangement of the knee which existed prior to military service is indicated only in carefully selected cases.

a. He should present a favorable mental attitude.

b. He should not have any other disability which will preclude full military duty.

c. The collateral and cruciate ligaments of the knee should be normal.

d. X-ray of the knee should be negative for joint injury or arthritic changes.

e. The quadriceps muscle should be nearly normal. Extensive quardiceps weakness or atrophy is a contraindication to surgery in these cases.

Meniscectomy in cases which do not fulfill these requirements will fail to restore the soldier to full military duty, and in the past many have required prolonged treatment and ultimate discharge from the service. Surgery for the repair of old injuries of the cruciate or collateral ligaments has not proved of sufficient military value to justify the procedure. Internal derangement of the knee joint incident to the service should be operated on if surgery will improve the soldier's military status or if it is necessary to relieve frequent or persistent symptoms disabling for noncombatant duties. In such cases, surgery should be performed without delay. Surgery for the initial injury or during the acute posttraumatic phase is usually contraindicated unless the knee does not unlock by conservative measures, including manipulation and traction, since the associated pain and effusion often lead to an erroneous diagnosis of dislocated cartilage.

Prepared by the Surgery Division, Office of The Surgeon General.

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2. Surgery. Incomplete removal of the meniscus, excision of the wrong meniscus, and extensive and traumatizing operations contribute to postoperative failure. Removal of both semilunar cartileges from one knee should be avoided and careful study and operative inspection of the knee joint should be made to determine the true pathology.

3. Postoperative care. After examinations of numerous knee cases operated on in station hospitals, it is apparent that the most important factor in the failures in cases presenting the proper indications is the disregard for preoperative and postoperative quadriceps muscle exercise. Hospitals which have given proper attention to such exercises have obtained correspondingly better results. Success following meniscectomy depends on a strong quadriceps muscle and careful surgery performed on a knee otherwise normal will fail if this detail does not receive the necessary attention. This factor is largely preventable by the establishment of a carefully supervised program. Attention is invited to consideration of this subject on page 3 in the March 1944 *Bulletin of the U. S. Army Medical Department* and in War Department Technical Bulletin TB MED 10, dated 14 February 1944.

DIAGNOSIS

Each case is not likely to have all the classical symptoms of internal derangement. Careful judgment is necessary for evaluation, especially after the acute symptoms subside and the patient arrives in a general hospital. The physical examination may present little evidence of pathology thus requiring the diagnosis to be made on the history of previous episodes. In doubtful cases, symptoms may be produced by strenuous exercise in the gymnasium or on an obstacle course so that proper evaluation can be made. Prolonged hospitalization is not justified for observation and therefore the diagnosis and a decision relative to surgery should be made within a week. In every examination the patient should be asked to demonstrate any "tricks" the knee may perform. The history of mechanism of injury, frequency and exact type of locking, and local tenderness must all be evaluated. The knee should be manipulated in the anteroposterior direction while flexed ninety degrees to demonstrate laxity of the cruciate ligaments and in the lateral direction while fully extended and while slightly flexed to demonstrate laxity of the collateral ligaments. Manipulation of the knee through the complete range of motion, first with the leg in abduction and external rotation and then

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with leg in adduction and internal rotation, is especially valuable in detecting a tear in the posterior portion of the cartilage. Each maneuver should be repeated in the normal knee for comparison. The most significant symptom is a recurrent "clicking" usually associated with pain and often causing the knee to "give way" on weight bearing. Rarely a semilunar cartilage may be damaged without a definite history of trauma. It is especially important to examine the patient recumbent with both lower extremities completely uncovered so that effusion or muscle atrophy will be apparent. Extreme care should be taken in obtaining the history and in the examination in order to avoid unnecessary surgery. When dislocation of a meniscus is causing painful recurrent symptoms or persistent locking, prompt surgery is indicated before severe quadriceps atrophy occurs which tends to further delay recovery. Routine x-ray plates should be taken in all patients with internal derangement of the knee joint, but these are of no value in the diagnosis of meniscus injury. Pneumo-arthrograms are not of sufficient diagnostic value to justify the procedure, and they are less accurate than clinical evaluation. Surgical exploration of the knee for diagnostic purposes is rarely justified and only those cases in which a definite diagnosis can be made should be subjected to operation. Occasionally the diagnosis is definite but it is impossible to determine whether the medial or lateral semilunar cartilage is damaged. In such cases if the first cartilage exposed is normal, the other side should be thoroughly inspected before excision of either. Excision of both cartilages should certainly be avoided unless both are fractured. The diagnosis "hypermobile cartilage" and "hypertrophic fat pad" should not be made carelessly, since they are often used to justify operation when the suspected pathology is not found. The traumatism code of standard diagnoses contains "062 *Articular* Cartilage of knee joint, dislocation of." Since the semilunar cartilage and not the articular cartilage is involved, the diagnosis should appear as "*Semilunar* Cartilage Medial (lateral) right (left) knee dislocation (fracture) of" followed by the manner of incurrence and operations. Appropriate corrections will soon appear in the revised list of diagnoses.

OPERATION

A damaged meniscus should be completely excised without leaving loose fragments and without injuring ligaments or articular cartilages. Very extensive incisions are not nec-

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essary unless there is other pathology to be treated or wide exploration is contemplated. Splitting of the patella, section of the quadriceps or patellar tendon, or partial section of the collateral ligaments are to be avoided. The tissues should be handled gently and the operative field should be visualized, so that no "blind surgery" is necessary. Numerous incisions and techniques have been described but all these requisites can best be met by the use of a single skin incision and a double capsular incision. The cutaneous incision is made over the medial or lateral aspect of the knee and the skin is undermined anteriorly for the usual anterior capsular incision which affords moderate inspection of the joint. The cartilage is detached as far back as the posterior third. After reflection of skin and subcutaneous tissue posteriorly, the detached portion is delivered through a small capsular incision behind the collateral ligament and the rest of the cartilage is visualized and excised. The same technique affords complete examination of the cartilage when the location of the pathology is in doubt. Postoperative immobilization should not be prolonged and the knee should not be flexed more than the minimum necessary for comfort. Skin traction is recommended for a few days, since it affords sufficient immobilization, is comfortable, and permits early exercise, but plaster bandage or posterior splint may also be satisfactory. A complete circular cast is not considered desirable. Circular bandage, whether muslin, elastic, or plaster, should be loosened or cut and then reapplied without undue tension if the knee becomes very painful because of postoperative swelling. The compression effect which may be desired is not of sufficient value to compensate for the severe pain caused by a tight dressing.

SUMMARY

Where derangement of the knee existed prior to military service, surgery should not be performed, and the soldier should be returned to limited duty unless he is found disabled for all types of military service.

The following types of cases should be operated on:

1. Exceptional cases, not incident to service, which meet all five criteria outlined above.

2. Line of duty patients who can be returned to duty by excision of a damaged semilunar cartilage.

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3. Line of duty patients who cannot be returned to limited duty unless surgery is performed.

4. Line of duty patients on whom surgery is considered essential before discharge from the service, unless operation is refused.

5. Any patient in whom full knee motion has become blocked by a displaced cartilage which cannot be reduced within a few days by conservative means.

The diagnosis, selection of case for surgery, operative technique, and postoperative treatment all require careful evaluation and mature judgment.

Diphtheria Susceptibility and Immunization

Diphtheria has presented practically no problem among troops in continental United States, the incidence being extremely low. However, reports have been received indicating a definitely increased incidence among civilians in the occupied countries of Europe (table I). It appears that the incidence of diphtheria in the Netherlands now is almost fifty times that reported during pre-invasion years. While the available figures can not be considered absolutely accurate, they indicate that diphtheria is a very real problem on the continent at this time. The reports give no indication that the increased prevalence has been seasonal in character; rather it is believed that the incidence may be expected to continue on a high level.

A preliminary report indicates that diphtheria has been present to an unexpected degree among the United States troops in one theater. While the disease has been prevalent among German prisoners of war, it has been controlled by treatment and mass immunization with fluid toxoid. Diphtheria has not been prevalent among Italian prisoners.

Cutaneous lesions, particularly in tropical regions, frequently harbor virulent *C. diphtheriae*. Studies at a general hospital revealed that 26 percent of two hundred seventy-eight patients with various skin disorders had virulent *C. diphtheriae* in the lesions and 25 percent avirulent diphtheroids. The typical tropical ulcer was the lesion most likely to contain the organism. About 38 percent of proved cases of cutaneous diphtheria were Schick positive when first seen.

Prepared in Preventive Medicine Service, Office of The Surgeon General.

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The instructions concerning diphtheria immunization contained in S.G.O. Circular Letter No. 162, 28 November 1942, are considered adequate for individual immunization and probably for application to small groups. However, they may not be applicable to mass immunization procedures. This consideration is based on the fact that large-scale Schick surveys may be impracticable in certain situations, on the probable high incidence of reactions when full doses of toxoid are used, and on the difficulties encountered in the administration of numerous small individualized doses.

A limited investigation of diphtheria among troops has been instituted and is now nearing completion. This study was designed primarily to determine (1) what proportion of U. S. troops are susceptible to diphtheria; (2) what degree and proportion of reactions are to be expected following the administration of diphtheria toxoid to troops; and (3) what method may be used to screen out the majority of reactors.

The groups selected for study were from an Army Ground Forces organization which has been in training for about a year comprising troops from places widely scattered throughout the country and from another camp comprising service units of comparable origin and training.

TABLE I

Reported cases of diphtheria

	Germany	Netherlands	Norway	Denmark	Switzerland	Sweden*
1935	132,930	1,762	625	3,807	1,824	916
1936	149,973	1,544	361	2,149	1,099	793
1937	146,666	1,079	413	1,348	722	299
1938	149,490	1,272	187	871	716	107
1939	143,585	1,273	72	1,106	751	188
1940	138,397	1,730	138	860	662	290
1941	173,161	5,501	2,609	917	1,114	252
1942	236,645	19,537	8,349	1,370	1,800	1,168‡
1943	282,859	53,469†	14,218**	——	709††	1,167‡‡

*Source, League of Nations.
†51 weeks.
**Jan. through Sept.
‡48 weeks. 2 weeks in July and 2 weeks Dec. missing.
‡‡Jan.-July, Feb. missing.
††1st 3 months.

Certain preliminary figures are available:

Results of Schick tests (table II). Among 2,933 individuals Schick tested, 1,289 or 44 percent were positive. A complete breakdown of the figures is not yet available, but the consistency of the results between the two main groups and among

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three smaller groups indicates that the groups are comparable and reasonably representative.

Reactions to diphtheria toxoid (table III). This portion of the study is being carried on in groups of about 300 in each of the two camps. Data are available only on reactions to 0.1 and 0.5 cc. doses. The results of larger doses administered to those who show no reaction to the smaller doses will be available later. The soldiers studied are from the same organizations as those Schick tested. On these small groups Schick tests were not performed as information was desired on the practicability of small doses of diphtheria toxoid in troops whose Schick status was unknown.

The test consisted of the intracutaneous administration of 0.1 cc. of toxoid diluted to contain 0.1 Lf. (flocculating unit) per cc. and at the same time the subcutaneous injection of 0.1 cc. of undiluted toxoid. The results of the two tests have not yet been carefully compared but figures giving an indication of the degree and proportion of the reactions encountered are available. About 5 percent of the individuals receiving the toxoid reaction test

TABLE II

Schick test results

Camp	No. tested and read	Positive						Negative						‡Unreadable	
		Pos.		Comb.		*Total		Neg.		Pseudo		†Total			
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
A—Group 1	526	203	39	21	4	224	43	233	44	64	12	297	56	5	1
A—Group 2	466	197	42	22	5	219	47	193	41	52	11	245	53	2	.4
A—Group 3	490	189	39	29	6	218	44	222	45	46	9	268	55	4	.8
A—Total	1,482	589	39	72	5	661	45	648	44	162	11	810	55	11	.8
B	1,451	533	37	95	7	628	43	694	48	118	8	812	56	11	.7
Total	2,933	1122	38	167	6	1289	44	1342	46	280	10	1622	55	22	.8

*Positive plus combined.
†Negative plus pseudo.
‡Control reaction greater than toxin reaction.

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dose were hospitalized, 3.7 percent were confined to quarters, and 15.6 percent having some untoward reactions continued on duty. About 75 percent had no reactions and, according to the plan, were retained for the 0.5 cc. of toxoid. Of the 429 persons who received 0.5 cc. of toxoid, 5.8 percent were hospitalized and 325, or 75.8 percent, were retained for further doses.

TABLE III

Reactions to diphtheria toxoid

0.1 cc. toxoid subcutaneously and 0.1 cc. dilute toxoid intracutaneously.

Injected	Reactions								No reaction; retained for further dose	
	Hospitalized		Quarters		Duty		Total			
	No.	%	No.	%	No.	%	No.	%	No.	%
Camp A, 292	20	6.8	6	2.0	50	17.1	76	26.0	216	74.0
Camp B, 298	10	3.4	16	5.4	42	14.1	68	22.8	230	77.2
Total 590	30	5.1	22	3.7	92	15.6	144	24.4	446	75.6

0.5 cc. toxoid subcutaneously

Injected	Reactions								No reaction; retained for further dose	
	Hospitalized		Quarters		Duty		Total			
	No.	%	No.	%	No.	%	No.	%	No.	%
Camp A, 209	7	3.3	0	0	45	21.5	52	24.9	157	75.1
Camp B, 220	18	8.2	18	8.2	16	7.3	52	23.6	168	76.4
Total 429	25	5.8					104	24.2	325	75.8

Reactions from larger doses (complete immunization) not yet available.

The criteria for further injections established for the purpose of this study are believed to be conservative. In the face of a high degree of exposure to diphtheria, a larger proportion probably could safely be retained for further immunization. Many of the reactions considered to be disqualifying for further doses were, in all likelihood, little if any more severe than those commonly seen following typhoid vaccination.

While no specific recommendations based on the preliminary data can be made, several points are emphasized.

1. Schick tests on what appears to be a representative sample of trained U. S. troops reveal that 44 percent of them are susceptible to diphtheria. While susceptibilty rates of this order do not seem to demand general immunization of all troops, they might be a cause for concern in the presence of a high degree of exposure. This Schick-positive rate is consist-

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ent with that found by Fothergill and others in a study on naval recruits two years ago. It is believed that the finding of appreciably lower Schick-positive rates in other studies of U. S. troops should not be accepted without question, unless there is a definite history of exposure to diphtheria or of recent immunization within the group.

Medical officers should be alert to the possibility of diphtheria. Several reports have indicated that cases have not been diagnosed prior to the onset of symptoms or signs of paralysis. The failure of some medical officers to diagnose diphtheria in its early stages probably is due to relatively little clinical experience with diphtheria in certain parts of the United States.

2. The indiscriminate administration to troops of diphtheria toxoid in the regular dosage may be expected to result in a relatively high proportion of reactions. The subcutaneous administration of 0.1 cc. of undiluted toxoid should screen out an appreciable number of such reactions.

3. In situations where exposure is unavoidable and when Schick surveys of large groups are impracticable, the general administration of 0.1 cc. of toxoid given subcutaneously might be desirable, with subsequent administration of regular doses to nonreactors. Reactors to subsequent doses could then likewise be dropped. That procedure should raise the general level of immunity sufficiently to prevent a serious outbreak. In fact, a small dose of the toxoid often affords an effective antigenic stimulus in persons with some latent immunity.

U. S. hospital train, loading patients somewhere between Naples and Caserta, Italy.

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Original Articles

Treatment of Burns in Forward Areas

MAJOR COLEMAN C. JOHNSTON
Medical Corps, Army of the United States

Observations are reported on the treatment in New Guinea of 108 patients suffering from burns, nearly 80 percent of whom received their initial definitive treatment at an evacuation hospital; the remainder were admitted from three to fifteen days after injury. Six of these patients died. The exact circumstances surrounding many of these accidents are difficult to determine, but it appears safe to say that over 90 percent of them were the result of gasoline fires or explosions.

The useless carnage resulting from carelessness and utter stupidity is in tragic contrast with the unavoidable injuries of war. In reviewing 48 records it was found that 66 percent of these accidents fell in this group and that only 2 of the 6 who died earned the badge of heroism. Were these records more complete, it seems certain that the careless and indiscriminate use of gasoline would be found responsible for a still higher percentage of these casualties.

Neither first-aid nor definitive treatment shows any evidence of standardization. Circular Letter No. 161, Surgeon General's Office, 11 September 1943, outlines a routine to be followed henceforth. In the group of patients initially admitted here, some were wrapped in a blanket, others were covered with vaseline, unguentine, tannic acid jelly, lard, or oil. All were adequately sedated with morphine. Most of the burns initially treated elsewhere had been carefully débrided. Vaseline gauze, tannic acid, or gentian violet were the predominant forms of treatment. In transit, however, dressings had become saturated with serum, adhesive strapping had given way, bandages were loose and often raw surfaces were exposed. A group of patients evacuated from a forward area was treated with tannic acid and light bandages.

These cases revealed the difficulty of preventing sepsis and presented the discouraging problem of excising the toughened adherent eschar from a bed of infected granulation tissue. Sepsis, toxemia, secondary anemia, and inanition added

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much to the burden of these miserably uncomfortable patients. Limited nursing care, rugged transportation facilities, heat, and flies accentuate the dangers of patients whose burns are not completely and securely encased in thick, well-padded, evenly distributed, and snugly applied durable pressure dressings.

TREATMENT

In the treatment of burns, limited facilities in the combat areas demand simple, direct, and effective methods to be quickly applied in preparation for early evacuation. Our initial management of fresh burns was, in the main, based on the principle of pressure dressings. With experience, we swung farther and farther away from the escharotic, the dye, and other forms of treatment.

Our most gratifying results have been attained with the following routine: Immediately following the patient's admission, he is placed in the operating room and intravenous plasma and oxygen therapy are begun. Preparations are made as for a major surgical procedure. Morphine alone will suffice for relief of pain. Clothes and dressings are removed. Ether may be necessary to remove a coating of ointment. All operating room personnel are capped and masked. Under sterile conditions—drapes, gloves, and gowns, if practicable—the burned area is gently washed with cotton, white soap, and warm, sterile water, care being taken to avoid breaking any blisters. The soap is removed with copious washings of sterile water. Saline is not efficient. The meticulous time-consuming débridement except in charred areas is entirely unnecessary. A stimulating dose of tetanus toxoid is administered in each case.

A layer of fine-meshed sterile vaseline gauze is placed over all burned areas and covered with large quantities of evenly distributed fluffed gauze and, when available, sterile cotton waste. This is fixed in place with a very snug 5-yard roller bandage and then covered with stockinet. The pressure dressing greatly facilitates nursing care when personnel is overtaxed. Living conditions are primitive and unconventional transportation is the prelude to successful early evacuation.

The extremities are placed in almost complete extension. The dressing is calculated to immobilize the part. Circulatory disturbances of the extremities must be carefully guarded

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against but should not occur if the proper degree of pressure has been evenly applied. If this type of dressing is properly applied and the professional enthusiasts along the line of evacuation can resist the temptation to remove it, it should remain in place from fourteen to eighteen days. One of our patients, evacuated seven days after applying a stockinet pressure dressing to the arm and leg for burns of the same degree, traveled only a short distance before someone exposed the arm. The leg dressing was not removed, however, and by the time he got to Brisbane after sixteen days, the leg was healed, but the infected arm required much care for some time.

Six of our patients with burns covering more than 80 percent of the body surface died. All were admitted within one and one-half hours of injury; four died within twenty-four hours; one lived forty-eight hours; and another lived eight days. All received large quantities of intravenous fluid. Two were given 5 percent glucose in saline along with plasma; both developed marked edema. The fact that the sodium ion causes water retention is obviously a definite contraindication to the use of normal saline until well after shock is controlled.

Formerly, anesthesia, débridement, and the application of pressure dressings were delayed while shock was being vigorously combated with intravenous plasma. We now feel strongly that the sooner the pressure dressing is applied, the quicker shock can be controlled. Just this form of bandaging the extremities is one of the oldest effective methods of treating shock. In addition to this, pressure prevents the surface exudation and vascular extravasation of tissue fluids.

Early in our experience, we gave up the local application of sulfonamides. In two patients who became and remained very cyanotic from the second to the fourth day after the use of sulfanilamide crystals locally, the blood sulfanilamide was found to have reached 16 mg. per 100 cc. The question of local irritation from chemotherapy with cellular destruction and retardation of healing is still unsettled.

The experience gained at the Massachusetts General Hospital following the Cocoanut Grove disaster in Boston indicates that the controlled oral administration of the sulfonamides is safer and just as effective. They found the sulfonamide concentration of blister fluid equivalent to that of the blood concentration.

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Where venous channels cannot be used for fluids, it has been reported[1] that, by means of a short, strong needle introduced into the medullary canal of the sternum, 22,000 cc. of fluid, including 9,000 cc. of whole citrated blood, were given during a period of nine days. The needle was left in place the entire time, without subsequent damage. We used this method with only moderate success in three patients.

A simple and practical means of determining the quantity of plasma to be given in the first twelve hours is to multiply the percentage of body surface burned by 50, thus giving the number of cubic centimeters of plasma necessary.

Berkow's table gives:

Lower extremities and buttocks	38 percent.
Trunk	38 percent.
Upper extremities	18 percent.
Head	6 percent.

One-third of the quantity thus calculated should be given in the first two hours, the next third in the following four hours, and the remaining fraction in the last six hours. When available, repeated studies of hemoconcentration should govern intravenous therapy.

We have seen infection in cases treated early as described, only when dressings failed to remain in place. If sepsis does occur, it must be controlled by chemotherapy and local hot wet compresses. Boric acid solution has served well. Azochloramid dressings are effective but rather painful. We often use the daily warm saline bath.

CONCLUSIONS

1. The first-aid treatment of burns might well be limited to morphine and pressure dressings.

2. Careful gentle cleansing of burned areas with white soap and water under the best of surgical technique is essential.

3. A meticulous, time-consuming débridement except in charred areas is entirely unnecessary.

4. The local application of sulfa-crystals is best replaced by controlled oral administration of the drug.

5. Intravenous shock therapy should be limited to the use of plasma alone until shock is well under control.

6. The earlier pressure dressings can be applied, the easier shock can be prevented or controlled.

1. Doud, E. A., and Tysell, J. E.: Massive Intramedullary Infusions, J. A. M. A., 120: 1212-1213, 12 Dec. 1942.

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7. Intramedullary clysis may prove lifesaving when venous channels have become obliterated.

8. Burned areas must be completely and securely encased in thick, well-padded, evenly distributed, and snugly applied durable pressure dressings that are designed to remain in place for fourteen to eighteen days.

Soft Fibroma

Case Report

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Fibromas are benign connective tissue tumors of slow growth, usually encapsulated. The varieties of fibroma are papillary, neurofibroma, angiofibroma, lymphangiofibroma, and other types, depending on which structures appear in the greatest percentage. Two types of fibroma exist, the soft and the hard type. The main difference between the two types is that the soft fibromas are composed of a loose structure of connective tissue fibres and spaces filled with serous fluid, while the hard type consists of a very dense fibrous tissue and very scant cellular elements. There are many varying stages between the soft and hard fibromas which may undergo hyaline, mucoid, fatty, and calcareous degeneration, or have a tendency to cartilage or bone formation. The soft form is often pedunculated while the harder type tends to lie more within the surrounding soft tissues. Often they are the result of chronic irritation from dentures, cavities, bridges, or any other irritating factor. Some, however, may result from embryonic or misplaced tissue. They occur most frequently in the lower jaw. They are most common in middle age.

CASE REPORT

Aux. C., 41, white, reported to the Dental Clinic for dental survey. She wore full dentures and complained of a growth under her mandibular denture on the left lingual aspect, which at times produced pain on mastication and swallowing. She noticed that this growth was getting larger in the past year and

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would tuck it under her denture to get the denture to set in position. On oral examination a large rectangular growth of tissue was noted extending about from the crest of the ridge to the floor of the mouth and from about the region of the retro-molar triangle to about the first molar region on the lingual surface of the left mandible. It projected out lingually about 3 mm. It was slightly inflamed and deeply grooved in several places. On pressure there was slight tenderness but no bleeding or discharge was noted. On examination of the dentures it was noted that the lingual surface was overextended in this area and curved

FIGURE 1. Mold showing soft fibroma before operation.

sharply inward under the border of the mylohyoid line. The patient was hospitalized and a biopsy was made of the region. A report of chronic inflammatory tissue, fibrosis, and hyperplasia of stratified squamous epithelium was made. Under local anesthesia, elliptical incisions were made from one end of the lesion to the other and carried deep in a V-shaped manner, so as to conserve tissue and to remove the lesion in its entirety. No suturing was necessary, and slight bleeding was controlled by pressure.

Photograph by U. S. Army Signal Corps.

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Sulfanilamide powder was placed against the denuded area and held in place by a gauze sponge compressed by the patient's tongue. This was repeated every half hour for about five hours. Subsequent treatments consisted of drying and then swabbing the wound with merthiolate and Talbot's Iodoglycerol. Healing was uneventful. Patient was discharged from the hospital eight days later. The laboratory reported the tissue as consisting of collagenous connective tissue containing numerous vascular and lymphocyte clusters. Many of these clusters tended to be localized about the lymphatics. This suggests that it may be a lymphangiofibromatous type of soft fibroma. (Figure 1)

CONCLUSION

Soft tissues must be respected in denture construction, especially in the posterior lingual aspect of the mandible. This soft fibroma was caused by denture irritation.

Attempts to Produce Jaundice in Horses by Inoculation of Yellow Fever Vaccine

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Studies on "catarrhal jaundice" or epidemic hepatitis of man have been handicapped by the lack of a susceptible laboratory animal. Theiler[1] described an acute liver atrophy in horses following the use of serum and the virus of African horse sickness in an immunizing procedure. Jaundice in horses following the administration of equine encephalomyelitis vaccine and antiserum has also been reported by Marsh,[2] Shahan,[3] and Mohler.[4] In the immunization of military personnel against yellow fever, numerous cases of jaundice followed the use of particular lots

Colonel William R. Wolfe, V.C., rendered valuable assistance in this work.

1. Theiler, Sir Arnold: Acute Liver Atrophy and Parenchymatous Hepatitis in Horses, 5th and 6th Reports of the Director of Veterinary Research, Union of South Africa Department of Agriculture, Volumes 5 and 6: 7-164, 1918.
2. Marsh, Hadleigh: Losses of Undetermined Cause Following an Outbreak of Equine Encephalomyelitis, J. Am. Vet. M. Ass., 91:88-93, 1937.
3. Shahan, M. S., Giltner, L. T., Davis, C. L., and Huffman, W. T.: "Secondary Disease" Occurring Subsequent to Infectious Equine Encephalomyelitis, Vet. Med., 34:354-358, 1939.
4. Mohler, J. R.: Report on Infectious Equine Encephalomyelitis in the United States in 1939, U. S. B. A. I., 4 pp. illust., 1940.

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of yellow fever vaccine.[5] These observations suggested the desirability of attempting to reproduce the human disease in horses with a view to using these animals in experimental studies.

The project reported in this paper was initiated by direction of The Surgeon General of the U. S. Army, following consultations between personnel of the International Health Division of the Rockefeller Foundation and the Preventive Medicine Division and Veterinary Divisions of The Surgeon General's Office. Initial protocols were prepared by Dr. W. A. Sawyer of the Rockefeller Foundation, Brigadier General Raymond A. Kelser, Chief of the Veterinary Division, and Colonel (now Brigadier General) S. Bayne-Jones of the Preventive Medicine Division of The Surgeon General's Office. The project was then assigned to the Army Veterinary Research Laboratory at Front Royal, Virginia.

EXPERIMENTS

Yellow fever vaccine was injected subcutaneously into horses and followed with laboratory and clinical studies of each animal for a period of four months. All horses were also kept under general observation during the fifth month. The detailed laboratory studies included icterus index determinations and leukocyte counts twice a week and erythrocyte counts once each week. The temperature was taken twice daily at which time each animal was carefully observed. Since the behavior of yellow fever virus in horses had not been reported, it was believed desirable to determine something of the fate of the virus following injection. To detect the presence of yellow fever virus in the peripheral circulation of horses, mice were injected intracerebrally with serum from certain horses on each of ten days following injection of the vaccine. Other suspected icterogenic materials (plasma, sera) from human sources were inoculated into horses as the materials became available.

Yellow fever vaccine was supplied by the International Health Division of the Rockefeller Foundation in quantities sufficient to perform all the inoculations. In each experiment, a vaccine lot known to have been associated with the occurrence of jaundice in man was used. Control animals were inoculated with vaccine which had not been icterogenic to man. Each ampule of vaccine was tested for the presence of living yellow fever virus at the time of use by the intracerebral inoculation of six white mice. In each test, several mice became char-

5. The Outbreak of Jaundice in the Army, Circular Letter No. 95, Office of The Surgeon General, War Department, Washington, D. C., 31 August 1942.

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acteristically paralyzed and all died between the 9th and 12th days following inoculation. This indicated that viable yellow fever virus was present in each ampule. The horses were selected at random from those being maintained at the Front Royal Remount Depot. All were in good health and flesh and ranged in age from 6 to 21 years.

The icterus index determinations were made from clear serum diluted 1:10 with physiologic saline solution. The color density of these serum solutions was determined by means of an electrophotometer. To use the electrophotometer, a calibration curve was prepared by making readings on more than one hundred equine serum samples. The icterus index of each of these samples was also determined colorimetrically. The colorimetric determinations were made with a Klett colorimeter by comparing the color density of the serum saline solutions with a standard potassium dichromate solution prepared according to the method of Kolmer and Boerner.[6] It was desired to provide a wide distribution of readings for the calibration curve and to determine the ranges for normal and clinically icteric horses. Consequently, readings were made by both methods on the following serum samples: one hundred from normal horses (eighty of which had been inoculated with yellow fever vaccine a few days previously) and fourteen samples from horses which had been given variable doses of phenothiazine. In the normal horses the icterus index varied between 6.0 and 15.0. Seven of the horses which received phenothiazine developed subclinical icterus with an icterus index of 15.7 to 30.8. The jaundice of one other horse in the latter group was recognized clinically. In this case the icterus index was 50.0. In the course of other studies, frank cases of jaundice in horses were encountered in which the icterus index reached 100.0. The calibration curve thus established was used to determine the icterus index direct from the electrophotometer reading.

In this project, a total of 1,046 red blood cell counts, 1,890 white cell counts, and 1,970 icterus index determinations were completed. In addition, 750 intracerebral mouse inoculations were made.

EXPERIMENT 1. Ten horses were used in this experiment. Horses numbers 1 and 2 each received 25 cc. of lot 367 of yellow fever vaccine, which contained human serum and was suspected of having been icterogenic to man. Six horses (numbers 3 to 8 inclusive) each received 5 cc. of this same

6. Kolmer, John A., and Boerner, Fred: Approved Laboratory Technic, pp. 233 and 234. New York: D. Appleton-Century Co.

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material. Control animals (numbers 9 and 10) each received 25 cc. of lot 359, which contained human serum but had not been icterogenic to man. Observations and laboratory tests on the horses were performed as indicated above.

Tests to detect circulating virus were performed in this experiment. For ten days following the inoculations, blood was drawn daily from each horse and the serum separated. Six white mice were inoculated intracerebrally under ether anesthesia with 0.03 cc. of serum from each horse. Each group of mice was observed for 21 days following inoculation. The brain was removed from each mouse which succumbed between the 6th and 21st days following inoculation and preserved at —70° C. These brains were then sent in dry ice to the Laboratories of the International Health Division of the Rockefeller Foundation, New York City, where subinoculations were made for the identification of yellow fever virus.

EXPERIMENT 2. Ten horses were also used in this experiment. Horses numbers 11 and 12 each received 25 cc. of lot 338 yellow fever vaccine. This lot contained human serum and was suspected of having been icterogenic to man. The next six horses (numbers 13 to 18 inclusive) each received 5 cc. of lot 338. As a control, 25 cc. of lot 359 were given to two horses (numbers 19 and 20).

EXPERIMENT 3. In this experiment, lot 334 of vaccine was given to two horses (numbers 21 and 22) in 25 cc. amounts; six other horses (numbers 23 to 38 inclusive) received 5 cc. each. This lot of vaccine contained human serum and was believed to have been icterogenic. Lot 359 was injected in 25 cc. amounts into two horses (numbers 29 and 30) as controls.

EXPERIMENT 4. This experiment was a repetition of experiment 3. Horses number 31 and 32 each received 25 cc. of lot 334 and horses numbers 33 to 38 inclusive received 5 cc. of the vaccine. Lot 359 was again used as a control and was given to horses numbers 39 and 40 in 25 cc. amounts.

EXPERIMENT 5. In this experiment, two horses (numbers 41 and 42) each received 25 cc. of lot 334 while six horses (43 to 48 inclusive) received 5 cc. Control lot 1017 was injected into horses 49 and 50 in 25 cc. amounts. This later lot of vaccine did not contain human serum and had not been suspected of producing jaundice in man.

EXPERIMENT 6. Horse number 36, of experiment 4, developed mild jaundice and fever on the 6th day following inoculation of vaccine. This event will be discussed later. Serum and defibrinated blood were collected from this horse and used to inoculate the two horses of experiment 6. Horse number 51 received 15 cc. of defribrinated blood subcutaneously. Horse number 52 received 15 cc. of serum. Each of six mice was inoculated intracerebrally with 0.03 cc. of this serum. All these mice survived a 21-day observation period. Observations and laboratory tests were performed on these two horses as in the other experiments.

EXPERIMENT 1S. Material from human sources was received from Dr. Joseph Stokes, Jr., of Philadelphia, Pennsylvania. This material was received with the following history: On 5 June 1942, Dr. L., suffering from an attack of mumps, was given 200 cc. of mumps convalescent plasma. Seventy-

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seven days later, Dr. L. developed "catarrhal jaundice" similar in type to that which had occurred following administration of certain lots of yellow fever vaccine. The plasma administered to Dr. L. had been obtained at Fort Bragg, N. C., from soldiers who were convalescent from mumps. Of this plasma (Bragg) 100 cc. were received in a frozen state. Serum was collected from Dr. L. three weeks following his attack of mumps. This was pooled with the serum of 9 other donors and dried *in vacuo*. One hundred cc. of vacuum-dried serum were received, of which approximately 12 percent was contributed by Dr. L.

Horse 1S was given 10 cc. of mumps convalescent plasma (Bragg) subcutaneously. Horse 2S was given 90 cc. of this same plasma. This animal exhibited an anaphylactic reaction immediately after completion of the injection but adrenalin was administered and the symptoms soon abated.

The desiccated convalescent serum of Dr. L. was resuspended in sterile distilled water; 10 cc. were given to horse 3S and 90 cc. to horse 4S.

Observations and laboratory examinations were conducted as in the other experiments.

DISCUSSION

The results of all of the experiments described were essentially the same; hence, they will be considered together. Elevated temperatures were frequently encountered in the horses used in this study; however, their occurrence could not be attributed to the inoculation of vaccine, and their apparent spread between groups of animals in these experiments indicated that the fevers were due to mild equine influenza, which was enzootic at this depot during the time of these experiments. Similar symptoms were observed in other groups of animals being maintained at this station. Occasional changes in the leukocyte count were also encountered. Leukocytosis was most frequently seen, which lends support to the opinion that the symptoms were due to equine influenza.[7] It is apparent that these variations were not related to the problem under investigation.

With one exception, no significant increase in the icterus index was encountered in any of the horses in these experiments. Horse 36, of experiment 4, developed mild jaundice on the sixth day following inoculation of yellow fever vaccine. A fever (104.6° F.), moderate depression, accelerated respiration, and anorexia were also evident at this time. The icterus index was 20.7 on the 6th day, 22.7 on the seventh day, 18.1 on the 8th day, and below 16 on the 9th day. No changes were noted in the blood picture. The next day the temperature abruptly returned

7. Maurer, Fred D., and Jones, T. C.: The Blood Picture in Equine Influenza, Am. J. Vet. Res., 4:257-264, July 1943.

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to normal. Blood and serum were collected from this horse on the sixth day and inoculated subcutaneously into horses (experiment 6) and intracerebrally into mice with entirely negative results. The icterus index rose moderately again on the 29th day of the experiment, reaching a maximum of 22.2. This mild subclinical jaundice persisted for eleven days, then abated. No further symptoms were observed in this animal nor could the jaundice be transmitted. It is probable that the symptoms in this animal were due to a concomitant infection and were not associated with the inoculation of yellow fever vaccine.

In experiment 1, a small percentage of the mice inoculated intracerebrally with horse serum died. After bacteriological studies and subinoculation of mice it was determined that these deaths were not due to yellow fever virus but to an intercurrent bacterial infection. In no case was yellow fever virus recovered.

SUMMARY

Forty horses were inoculated with yellow fever vaccine from lots which were associated with the occurrence of jaundice in man. Ten horses received vaccine which had not been icterogenic to man. Four horses were given human plasma and serum which also may have produced jaundice in man. No disease resulted which could be compared to the human disease known variously as "catarrhal jaundice," epidemic hepatitis, infectious jaundice, and "postvaccinal hepatitis." Yellow fever virus was not detected in the serum of horses following subcutaneous inoculation of vaccine containing living virus.

SOUND PROFESSIONAL JUDGMENT

The induction of the 18- to 20-year-old groups has presented special problems. It is well known that while some youths in this age group are well matured both physically and emotionally, others are not so well developed. All medical officers, and especially neuropsychiatrists, are required to be especially observant for the immature individual so that he can be rejected or deferred for re-examination at the end of six months, thus preventing unwarranted risks to the underdeveloped. While regulations can be laid down to govern selection, nothing can be substituted for sound professional judgment. (Halloran, Roy D., and Farrell, Malcolm J.: The Function of Neuropsychiatry in the Army, Am. J. Psychiat., 100:14-20, July 1943)

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Apparatus

PLASTER FOOT MODELS

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Medical Corps, Army of the United States

The custom of the service is to have all men order special shoes when they cannot be fitted with general issue shoes. Such special orders are accomplished through the quartermaster by completing the Q.M.C. Form No. 407 which includes the foot measurements and the medical officer's recommendations. Unusual feet are divided into two categories: the large foot (size 14 and up, especially with unusual widths), and the deformed foot. General issue shoe sizes will take care of many of the former group, but they will not do for any of the latter group. It is frequently incumbent on the medical officer to prepare a foot model in order that correct shoes may be obtained. The following description is prepared for guidance in such situations.

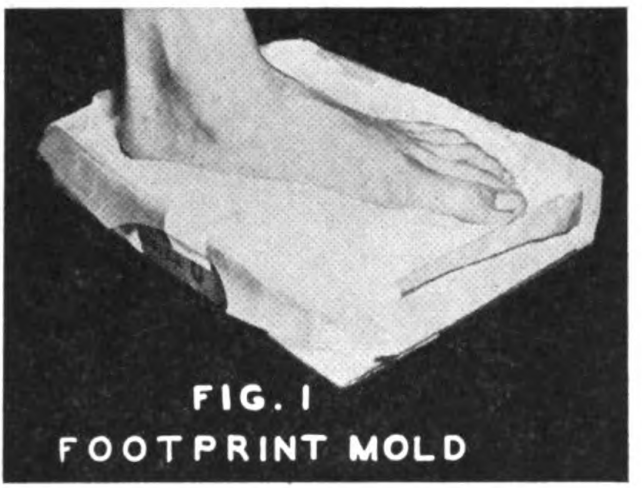

FIG. 1
FOOTPRINT MOLD

Preliminary foot measurements are taken and recorded on Q.M.C. Form No. 407, which is to accompany the models. Obtain a cardboard box some 5 centimeters longer than the foot; trim the sidewall height to about 5 centimeters; then fill this box with a 4-centimeter layer of plaster of paris. As the plaster begins to thicken, the sitting patient places one foot into it and exerts moderate pressure causing the plaster to fit well up under the toes and around them to their greatest diameter, and also to meet the skin at the top of the medial border of the longitudinal arch of the foot (figure 1). It is necessary to exert only moderate force to flatten the foot sufficiently for model purposes. With the patient standing and holding an added weight of 50 pounds, his foot lengthens and widens a maximum of only 3 to 4 millimeters each. The widening is due mainly to pronation of the arch diameter (see figure 2: reduced 1/7 actual size).

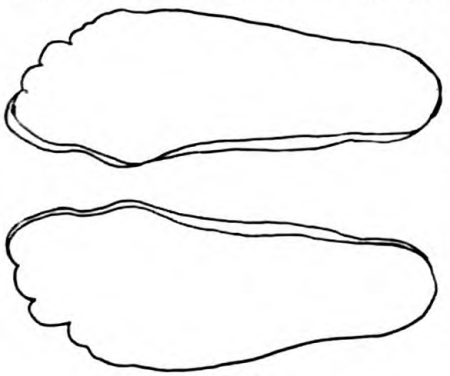

FIG. 2
FOOT PRINTS

The plaster is soon set and, on removal of the foot, allowed to harden thoroughly. Usually it is allowed to stand overnight, and it is more convenient to have the man return the next day.

At the second sitting, one plans to complete the external impression as

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shown in figure 3. The footprint mold previously made is now thoroughly soaped with tincture of green soap which prevents adherence of skin or plaster. The feet are shaved to shoe-top height; then cut strips of 1-centimeter adhesive and 2-centimeter width waxed paper the length of the three cast-splitting lines (widely notched in figure 3) and, in addition, strips for a vertical line on the posterior aspect of the heel. The waxed paper strips are folded longitudinally and stuck to the foot with the adhesive along the lines noted, so they fold at right angles and form vertical partitions for the division of the cast for removal. The remainder of the foot is covered thinly with vaseline. With the foot in the footprint mold, apply a 1½-centimeter layer of plaster to the outside of the foot to shoe-top height. As the plaster begins to set, cut a wedge along the partitions to allow the escape of gasses and heat and also for ease in the removal of the cast segments. When the plaster is firmly set, remove the segments and allow them to harden. About forty-five minutes are required for hardening during which time their internal contour may be smoothed out if necessary because of cracking or bubbling. The segments are then fitted together on the footprint base and solidified by spotting dabs of plaster along the fracture lines. At this time, any large irregularities of the fracture lines may be filled in. When the mold is thoroughly solid, the inside is to be well soaped.

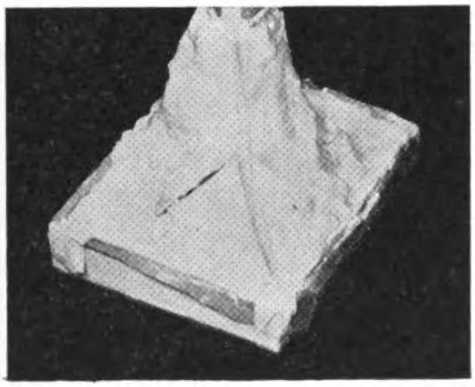

FIG. 3. EXTERNAL IMPRESSION

The third step consists of pouring the model. This is done by slowly pouring thin plaster of paris into the mold. This procedure may be facilitated by vibrating the mold while pouring. For vibration, one may use an eccentric wood block on an electric motor shaft (as is commonly used in the dental laboratory). This vibration aids the gaseous escape and, with the mold held in various positions, the toes are well filled. When filled, the whole is set aside for forty-five minutes to harden. The external mold is now removed by splitting it at the fracture lines and the soaped interior prevents sticking. The model is allowed to harden for twenty-four hours; then the patient returns and the models and feet are compared. The plaster is not yet entirely dried and any discrepancy in contour may be readily sculptured. The model (figure 4) is then thoroughly dried for twenty-four hours. All hardening and drying stages may be shortened by using an electric bake cradle, but this is necessary only if haste is essential. In order to give a better surface, the model is varnished or shellacked.

FIG. 4
PLASTER FOOT MODELS

The models are now complete. They, together with Q.M.C. Form No. 407, are forwarded to the post quartermaster, who in turn forwards them through proper channels to have the shoes made and issued.

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